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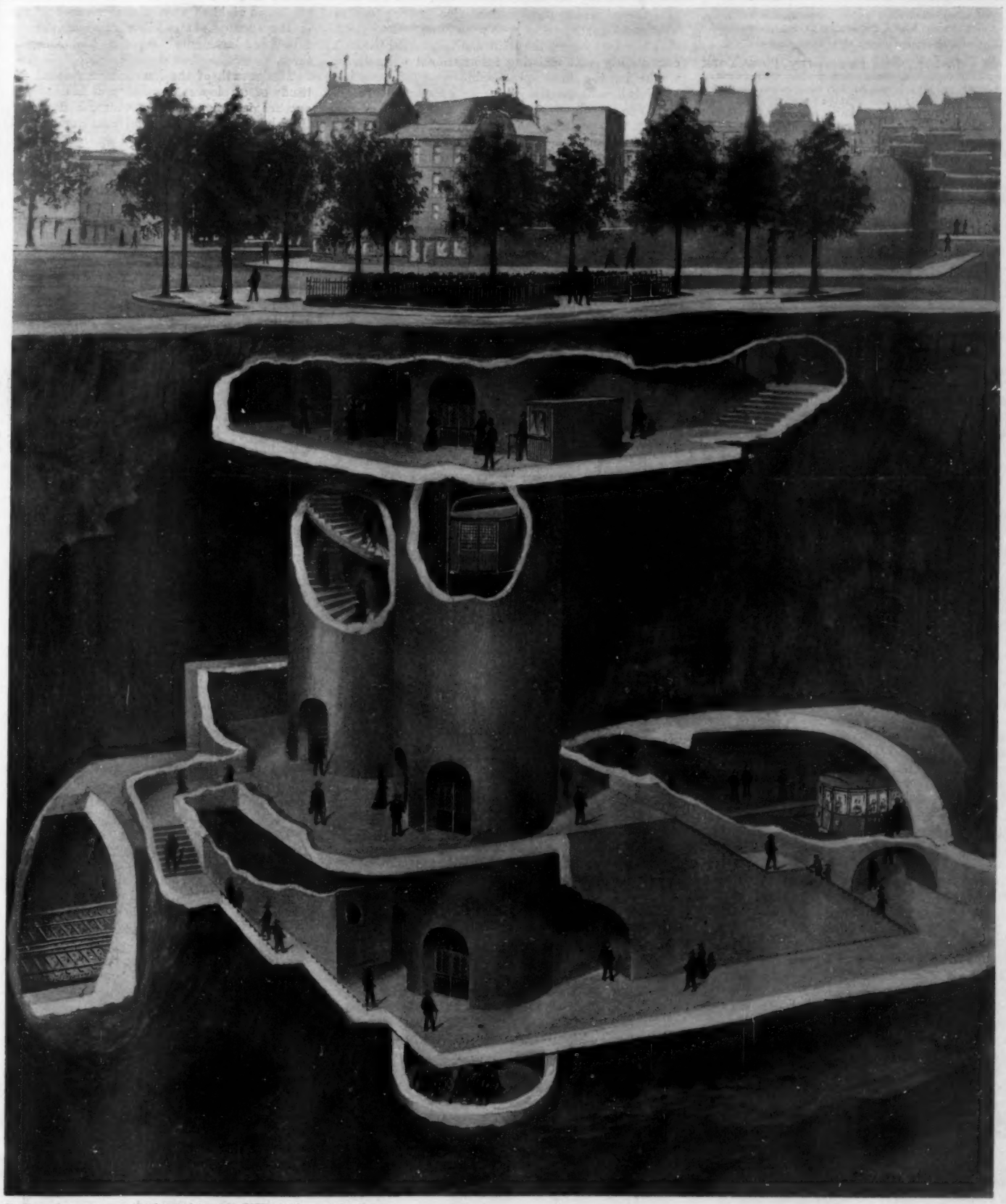

Redrawn by our own artist from pictures in *L'Illustration* and *La Nature.*

View of the elevator and staircase shafts at the Place des Abbesses underground station in the course of construction in Paris.

THROUGH THE HEART OF MONTMARTRE, PARIS, BY RAIL.—[See page 86.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Shall the Panama Canal Be Free?

WITH the approaching completion of the Panama Canal, the question of tolls becomes of increasing importance. It is one that should be settled at the earliest possible moment consistent with a careful and statesmanlike consideration of the problem from every possible viewpoint; and it should be possible for Congress to take definite action before the close of the present session. Literature upon the subject is plentiful, and we have before us three suggestions, one by John Barrett, another by Lewis Nixon, and a third by the New York *Tribune*, which represent three proposed plans that broadly cover the possible methods of settling this most important question.

John Barrett, as Director General of the Pan-American Union, speaks with authority on a subject which must exert a powerful influence upon the future trade relations between the United States and the Latin-American republics. His proposal represents the extreme altruistic view; for he would throw the canal open to the ocean-going traffic of the world without any distinction of flag whatsoever. We have used the term altruistic; although Barrett's argument would imply that he believes a free canal would result in greater ultimate benefit to its builders than any possible system of tolls. Thus, he argues that, since the estimated cost of operation and maintenance is three million dollars, and the interest on the approximate cost of the canal, four hundred million dollars, at a three per cent rate, would be twelve million dollars, the tolls should be adjusted so as to bring an annual income of fifteen million dollars. The actual traffic in 1915, he tells us, is conservatively estimated by trade experts at ten million tons, which would mean that each vessel that uses the canal would pay $1.50 per net ton for each passage. If the average ship passing through the canal measured 8,000 tons, it would have to pay a tax of $4,500 per trip, an amount which Mr. Barrett estimates would about equal in a low-speed freighter the entire wages of the captain and crew for the trip, —thus the total payments in a year would equal the legitimate income of the investment represented by the ship.

On the other hand, Mr. Barrett accepts the estimate of trade experts that a free canal would carry the first year $75,000,000 more of the products of the United States than a toll canal—an amount equal to the tolls for five years. At this rate for ten years, the increase would pay for the entire original cost of the canal and liberal interest on the investment, or a sum of $750,000,000. Says Mr. Barrett: "Will the United States deliberately throw away an opportunity to increase the sale of its products $750,000,000 in ten years in order to save $75,000,000 in tolls?"

Mr. Lewis Nixon, on the other hand, sees in the Panama Canal an opportunity to re-echo the principles and strengthen the bond of the Monroe Doctrine, which famous utterance, he says, "gave expression to the idea that there was a fraternal bond uniting the American States, by which closer union and co-operation are possible among them than between any of them and European States." So he would throw the canal open to all American flags, whether that of our own republic or those of Central and South America. He would give the Latin-American republics the use of the canal under conditions similar to those for our own flag now flying on any ship, or in the future flying on any ships of domestic build, meaning by this, vessels built on any land of any republic of the western hemisphere. In this connection, he thinks, it would be advisable to reciprocally extend our coasting trade laws by treaty to all of North, Central and South America, applying the same restrictions as to build and flag as those proposed for the privilege of navigating the canal.

The New York *Tribune* considers that the question of special privilege or profit to American shipping is worthy of consideration, and that the suggestion to make purely coastwise traffic free is worthy of consideration. We are inclined to think that this last suggestion, if it can be carried through consistently with existing international obligations, would be the most practicable way of securing special benefit to the maritime commerce of this country. Tolls or no tolls, the experience of the Suez Canal gives reason to believe that the opening of the Panama Canal will act as an enormous stimulus upon a large section of the world's ocean-borne trade. While the imposition of tolls may exert, as Mr. Barrett suggests, a repressive influence, we doubt if this effect would be as large as he fears. The Nixon plan is attractive, especially so to those of us who believe that a vigorous enforcement of the Monroe Doctrine is essential to the peace and security of the new world. Moreover, it would have the great advantage of acting as an enormous stimulus in building up the American merchant marine.

Success in Accident Prevention

PERHAPS the most effective tribute to the value of accident prevention devices at the recent meeting of the American Museum of Safety for the award of medals was that offered by Mr. R. H. Newbern, superintendent of Insurance Department of the Pennsylvania Railroad. We all believe that the introduction of simple and not expensive safeguards will do much to protect employees against those numberless accidents, some of them fatal, but the great majority of a minor, but painful and disfiguring character, which have been so numerous among our great artisan population; but it takes such statistics of actual results achieved as Mr. Newbern has given to show what effective work can be done in this direction. The speaker acknowledged the indebtedness of the railroad to the literature issued by the Liability Insurance Company, calling attention to safeguards which could be applied to machinery; and while they have been mindful of the welfare of their employees "in a broad humanitarian way," they determined to ascertain how much more could be done in providing additional safeguards. Consequently, the company employed experts of the Travellers' Insurance Company to make a report on its shops. A motive power inspector was detailed to accompany them, and as the result of about a year and a half of work, sixty-six shops of the railroad system, employing 50,000 men, have been inspected, and nearly four thousand machines and tools have been safeguarded at a cost which the company considers to be slight in comparison to the great protection afforded, the total estimated expenditure being about forty thousand dollars. In preference to asking for any special appropriation, the cost of these safeguards has usually been taken care of in the monthly allowance for repairs to machines and tools.

The safety committees are made up from among the employees, and, as it was feared that if the workmen made recommendations which, for certain good reasons, were not carried out, they might feel that they had a grievance, the question of makeup of the committees was left to the judgment of the various operating officials. As a result, there is wide diversity in the nature of occupation of these committees, the chairman being usually of a rank not lower than that of foreman or some one in authority. The terms of service are limited by a system of quarterly rotation of membership, and the members are paid for their full time and expenses. To an outsider this would appear to be an excellent arrangement, and that it works well is shown by the great decrease in accidents. The committees have taken a deep interest in the work, and their scope has been extended to cover not merely the shops, but the roadway, track, and various yards.

The results of operation are most gratifying. The reports of accidents in the shops show that in serious accidents there has been a decrease of from about 300 per month to slightly over 100. Although the safeguarding of machinery and the improvement of shop practice may be regarded as comparatively easy, the railroad company feel that the ground "has scarcely been scratched." They realize that the question of injury is not merely one of amputated fingers and crushed and bruised limbs, but that there are problems of sanitation, lighting, and improvement in general environment, which, by a proper solution, may result in bettered health and greater general efficiency of the employees. Furthermore, much attention, as noted above, is being given to the safeguarding of employees upon the track and roadbed, which is being done by the elimination of what have hitherto been considered ordinary risks. This includes the covering of open culverts, the increasing of train clearances, and the removal of obstructions along the track and right of way. Another excellent safeguard is the issuing of bulletins explaining the various causes of accidents and the best way to avoid them.

The growth of the humanitarian spirit in the attitude of employers to employees is one of the most encouraging signs of the times, and we commend the above facts for special consideration as showing in a concrete case and on a large scale how much may be accomplished in bettering the conditions of the great working class at a comparatively trifling cost to the employer.

An Object Lesson in City Improvement

THE decision of the authorities of New York to preserve City Hall Park intact and remove the present law courts building therefrom possesses a deep interest, not only for New York, but for every city in the country that is considering the question of improving its architectural appearance. The decision to place the new law courts elsewhere than in the park will cost the city dear—some six million dollars, in fact. Large as it is, however, this sum will have been well spent. The original scheme contemplated the covering of a large part of City Hall Park by the new building, and the cost would have been only that of the building—say nine million dollars, in place of the present estimate of fifteen millions. The adoption of this plan marks a decisive victory for the advocates of civic improvement, for the original scheme for a further encroachment on the park was abandoned only after an outburst of public indignation, the extent and sincerity of which were beyond all question. New York City for once has set a fine example, which will be a stimulus to other great cities that are confronted with similar conditions.

The determination to remove the present law courts building is a most happy one, for it will stimulate the growing desire on the part of the people of New York to have the unsightly brick building to the east of the court house and the ungainly pile of the Post Office at the southern end of the park removed, leaving the beautiful City Hall open to view from any thoroughfare by which the park may be approached.

The new building, which will be of monumental proportions, will occupy a tract of land to the north of, and immediately adjoining the Municipal Building, which is now nearing completion, and the additional sections of land adjoining the new site, which the city will probably acquire, will render it possible to create a civic center, which, in its extent and in the importance and grandeur of its buildings, will be comparable with similar centers in the leading cities of Europe. The later buildings to be erected will include a new Criminal Courts Building and, probably, a new Post Office and home for the United States Court. In laying out the plans, advantage should be taken of the opportunity to connect the Manhattan and the Brooklyn bridges by a broad plaza, suitable not only for the traffic which must develop through so important a district, but of sufficient width to afford an adequate view of the new buildings.

Roadside Fruit Trees

ATTENTION is called in a recent consular report to the thrifty plan followed in the province of Hanover, Germany, of planting the roadsides with fruit trees, the product of which is sold at auction for the benefit of the local government, the revenue thus obtained going a long way toward the upkeep of the roads. Hanover has some 7,000 miles of country highways thus bordered. This year some of the roads yielded a revenue, from this source, at the rate of $595 a mile. The fruit is protected by law, and during the season of ripening the roads are patroled by sharp-eyed watchmen, on bicycles, so that little if any of the fruit is diverted from its proper destination.

Engineering

A Year's Addition to the British Navy.—During the year 1911 forty warships were launched in the British Navy. These included 8 super-dreadnoughts, carrying 13.5-inch guns; 2 protected cruisers, 2 unarmored cruisers, 23 torpedo-boat destroyers, and 5 submarines. These ships aggregated 221,000 tons, and will cost, when completed, over $86,000,000.

Smoke Prevention in London.—According to a parliamentary paper, there are 7,875 smoke-consuming furnaces in London. Fifty-four different types of apparatus are used in the metropolis, all of which are effective smoke consumers. Up to the date of issuing the report, 672 convictions for smoke nuisances had been obtained before the magistrates.

The "Hawke"-"Olympic" Collision.—The White Star Line will appeal the recent decision of the Admiralty Court, which found that the navigation of the "Olympic" was to blame for the collision with the British cruiser "Hawke." This decision was based upon the fact that the evidence showed the "Hawke" to have the right of way. The question of suction does not appear to have weighed much, if at all, with the court.

A Battleship With Destroyer Speed.—It is announced in a despatch from Devonport dockyard, that the battle-cruiser "Lion" of the British Navy, during an eight hours' full power trial, broke all records of large ships by averaging over 31 knots speed. The vessel has 26,000 tons displacement and carries a powerful armament of eight 13.5-inch guns. Could she maintain this speed crossing the Atlantic (which we doubt) she would make the run in four days.

The Sun as a Lamplighter.—In the acetylene-burning lighthouses along the Panama canal will be installed copper cylinders exposed to the sun. When the sun rises in the morning and the rays fall upon these cylinders they will expand and close valves that admit gas to the burners. As night approaches and the sun's rays diminish in power the cylinders will contract and again turn on the gas, which will be ignited by small pilot jets.

Concrete Tests for Catskill Aqueduct.—The engineers of the Catskill Aqueduct have made a series of percolation tests of concrete to determine the solubility of the specimens. J. Waldo Smith, chief engineer, states that no definite evidence of solution of the aggregate was obtained, and it was shown that the solids carried off came from the cement. An examination of specimens tested under compression showed that the solution took place along the principal lines of percolation.

Traffic Through the Simplon Tunnel.—The report of the Italian State Railroads states that in the year ending June, 1910, the amount of freight entering Italy through the Simplon tunnel was 56,335 tons, and that 74,764 tons were shipped from Italy by way of the tunnel. The imports through the Mont Cenis and the St. Gothard tunnels were six times and thirteen times as great as by the Simplon tunnel. The exports were respectively twice and six times as great by these older routes as by the new Simplon road.

Tunneling the Caucasian Mountains.—According to a recent despatch from Paris, the Russian government is seriously considering the proposals of certain Swiss engineers to tunnel the Caucasian mountains near Tiflis, thus connecting the Black and the Caspian seas. Although the length of the tunnel would be sixteen miles, it is stated that the Russian government believes the commercial and strategic value of the tunnel would be such as to warrant its construction. The engineers estimate that the work could be completed in seven years' time.

Concrete Reinforcement of Tower Foundations.—The foundations of the tower of the main entrance to St. John's Cathedral, Denver, having settled, it was decided to strengthen them by building around the entire foundation of the towers a ring of reinforced concrete. This ring, which was 7 feet 6 inches in depth, was carried down 3 feet below the old concrete foundations. The ring varied in thickness from 2 feet 5 inches to 3 feet 8 inches. It was tied together by a system of tie-bars which were passed through steel tubes, placed under the old foundations.

Canal Efficiency in Europe.—In the course of an address before the New York Railroad Club, Prof. Edwin J. Clapp stated that the most efficiently operated waterways to be found in Europe are the rivers Rhine and Elbe. The shipping navigating these rivers is thoroughly modern, as are the means employed in the river harbors for collecting and distributing the freight; and he noted that there was a hearty co-operation between the rivers and the railroads. The River Elbe alone carries four-fifths of the trade of Hamburg to such material points as may be reached both by rail and river. We must not expect equal results in this country; for whereas Germany has a density of population of 290 per square mile, and Belgium of 620, the States of the Mississippi Valley have a density of only 34 per mile.

Science

A Timely Gift to Seismology.—Mr. Robert Wilcox Sayles, in charge of the geological section of the Harvard University Museum, has given the sum of $5,000 to the Seismological Society of America, to aid in the publication of the Society's *Bulletin*. This admirably conducted quarterly, the only seismological journal of America, has just completed its first year and volume.

Exploration of Crockerland.—George Borup, who was one of Commander Peary's mechanics in the Arctic Expedition of 1908, in conjunction with Prof. McMillan, will start northward about the middle of next July, for a three-year exploration of the Arctic regions. Their chief object will be to study the tract first seen by Peary on the last dash to the Pole and named by him "Crockerland." The tract lies one hundred and twenty-five miles north-northwest of the west end of Grantland, which is off the western coast of Greenland.

"Oxygen Compartments" on Mountain Railways.—A recent consular report on the nearly completed railway from Arica, Chile, to La Paz, Bolivia, which goes to an altitude of 14,105 feet above sea-level, states that the effect of the quick ascent and great altitude on people having weak or abnormal hearts is to be counteracted by having oxygen compartments in the passenger cars. Passengers subject to mountain sickness or any affection of the heart may, by occupying these compartments, breathe air having the same percentage of oxygen as at sea-level.

Biological Survey of the Canal Zone.—The last annual report of the Smithsonian Institution records the work of a party of ten naturalists sent by the institution, in co-operation with the Field Museum of Natural History and several of the government departments to make a thorough biological survey of the Panama Canal Zone. Large collections of material have already been received from the party, including many genera and species new to science. The undertaking derives special importance from the fact that the building of the canal is so disturbing natural conditions on the Isthmus that the data for a true understanding of the flora and fauna will soon no longer be available. The Republic of Panama has invited the institution to extend the survey within the limits of that country, and this has been done so far as the limited time and means have permitted.

An Observatory on the Little Feldberg.—The Physikalischer Verein of Frankfort-on-the-Main is building on the Little Feldberg, the second highest summit of the Taunus Mountains, a geophysical observatory that promises to play an important part in German scientific research. At present only a seismological station and a laboratory are being erected; but to these will be added later the necessary installations for upper-air research, as well as general meteorological and magnetic observations, including measurements in atmospheric electricity. This type of observatory, in which the phenomena of earth and air (and sometimes the solar processes) are studied simultaneously, is one of the interesting recent developments of "synthetic science." The Observatory of the Ebro, in Spain, is probably the best example.

A Banana Plant Disease.—A disease of the banana tree appeared for the first time in Trinidad upon the "moko" variety, according to M. Rorer, and is now spreading so much that it is attacking other varieties such as *Musa paradisiaca* and *M. Sinensis*. In this disease the leaves become yellow and then dry up and fall off. Within the fleshy parts of the leaf are formed numerous cavities which then increase in size and cause the death of the plant. When the diseased parts are cut, the vessels are seen to be of a brown color, and it is observed that they are full of bacteria. When the plant is but slightly attacked it still lives, but the fruit cannot ripen, and becomes brown and rots. M. Rorer observed the bacteria which cause the disease, and this he names *bacillus musae*. While engaged in inoculating it upon various banana plants, he found that the *M. textilis* was hardly affected by it, and the action was limited to a few of the plant vessels.

Date Seeds as Fodder.—In countries where the date furnishes a large percentage of the food supply for the populace, as in Northern Africa, the stones, or seeds, accumulate in vast quantities as apparently unprofitable rubbish. We learn from *Touche à Tout* that a way to utilize them has recently been discovered in South Algeria and Tunis. By a prolonged process of soaking the integument becomes soft enough to enable them to be used as fodder for camels, mules, etc. Their value as food material is proved not only empirically but analytically, as shown by the comparative table which we subjoin:

	Straw from Grain Per Cent.	Hay. Per Cent.	Date-stone Meal. Per Cent.
Nitrogenous matter ..	0.8	9.0	9.8
Hydrocarbons	36.0	45.0	26.0
Fatty matters	0.4	4.5	2.0

Aeronautics

Latham in Africa.—Hubert Latham has gone to the French Congo for big game and to study the possibilities of aviation in the French colonies. He has taken an Antoinette monoplane with him.

More Money for Zeppelin.—Because the German military authorities contemplate the building of more dirigibles, the Zeppelin Construction Company will shortly increase its capital from one to four million marks.

A Record Balloon Voyage.—The record for point-to-point ballooning in England was recently broken by C. F. Pollock. A distance of two hundred and forty miles was made in ten minutes under eleven hours, from Pembroke Dock gas works to Witham, Essex.

Transatlantic Flights in Aeroplanes.—In the daily press two announcements have been made of projects which have for their purpose nothing more or less than the crossing of the ocean by means of aeroplanes. One of these plans comes from Harry N. Atwood, the other from James B. Martin. Both men, according to the newspapers, will depend upon hydroplanes. The SCIENTIFIC AMERICAN hopes to comment upon the idea in an early issue.

The Doutre Stabilizer.—We have already referred to the success of the Doutre stabilizer for aeroplanes, noting that it was approved by several officers of the French army. More recently it was put through a series of trials at Rheims upon an aeroplane, in the presence of Gen. Rebikoff, of the Russian army, and he was so much impressed with its performance that he delegated two officers who are to follow all the experiments made with the apparatus in the future.

Types of Military Aeroplanes.—Whether one type of aeroplane will answer all military requirements is a question with which foreign military men are concerning themselves. It seems to be fairly well agreed that at least a single-seater scout and a two-seater are necessary. How far the French military authorities are right in demanding three-seated machines to carry heavy weights and to perform long journeys, is a moot point. Nevertheless, there are strategists who advocate still a fourth type, similar to the first, but armored. The function of that machine would be to destroy and not to scout.

The Color of Balloon Envelopes.—According to the researches of M. Reynaud, caoutchouc is strongly attacked by the ultra-violet rays from the mercury vapor lamp with a quartz tube, which is a powerful source of such rays. This fact has a practical bearing in connection with balloon envelopes which are treated with caoutchouc. Aeronauts are familiar with the discovery that the envelopes suffer during ascensions, and this is explained by the greater effect of ultra-violet rays at high altitudes. Experiment had already led to using yellow coloring matter on the envelopes, and red balloons are sometimes seen, but never blue or violet. M. Reynaud considers that red is the best color to use, as it not only absorbs the ultra-violet rays, but also the blue rays, and these last are likely to share in the bad action of the sun's rays upon balloons.

France to Control Aerial Navigation.—Aerial navigation has its first charter signed by M. Fallières, President of the French Republic, and countersigned by the Ministers of Public Works, Interior, War, Finance and the Marine, and promulgated in the form of a ministerial degree regulating aerial navigation in France. It has to be voted by the French Chamber and Senate before it becomes a law. The charter was issued in France to protect the public against inconveniences and risks which may result from imprudent and daring aviators, or by the imperfection of their machines. It gives the Minister of Public Works authority to act officially until the aerial navigation law becomes an actual fact. It consists of six chapters with a total of forty-two clauses. It stipulates that all airships (steerable balloons or aeroplanes) must bear a plainly visible registered number. Each machine must have a log book in which the names of persons carried and the times and places of departures and arrivals must be recorded. No explosives are to be transported without special permit. Wireless telegraphic and photographic apparatus is prohibited unless a special permit is obtained from the Minister of Public Works. Flights over cities and crowds are prohibited. It is also ordered that an airship must come to earth and stop whenever it is officially signaled so to do. The exact nature of the signals is still to be fixed. Every steerable balloon, while navigating between sunset and sunrise, must show a white light in front and red and green lights on either side, like a steamer. Aeroplanes are given temporary permission to carry one lantern only, but it must be placed in front and throw a green light to the right and a red light to the left. While flights over cities are thus forbidden in France, Park Commissioner Stover, of New York city, has, at the instance of Mayor Gaynor, selected special landing spots for aviators in the parks of various boroughs. This is the first official move to encourage aviation that has been made in the metropolis.

Recent Developments in French Dirigibles

The Construction of the "Lieutenant Selle de Beauchamp"

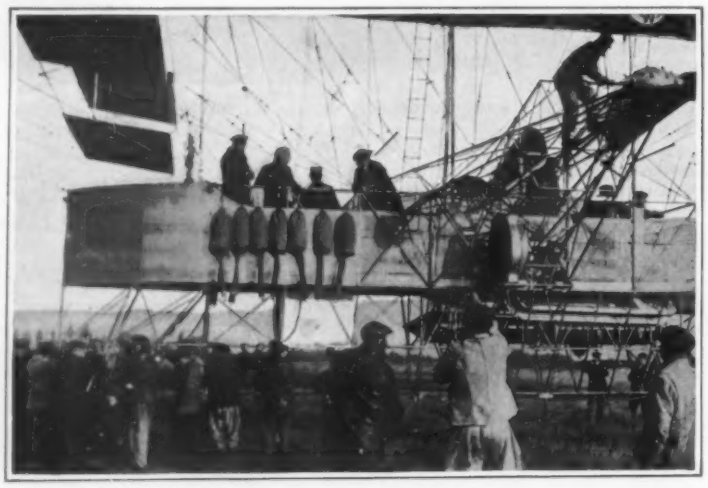
By C. Dienstbach

AFTER the "Republique" disaster in 1909 so little activity was shown in French dirigibles that the land which saw the birth of the dirigible seemed ready to discard an instrument in which it had taken great pride before it was equaled and even surpassed by Germany. Until the middle of 1911 only three very small units had been added to the depleted French airfleet, the "Astra-torres," the "Zodiac," and "Le Tempe." These were indeed efficient for their size and much used for inexpensive training. But the Government had only been biding its time, and it gradually became apparent that the authorities really were planning a reorganization of the entire fleet of dirigibles, by substituting for the very moderate displacement of the old craft a tonnage which would put the new constructions in the class of the Zeppelins, Shuette-Lanz, Siemens-Shuckert and all the other German dirigibles. The principal object of this was to make altitudes of 6,000 to 7,000 feet accessible to the French military dirigibles, where they would be immune from any attack save by aeroplanes, which might be fought off. But other important advantages of large size also were not lost sight of.

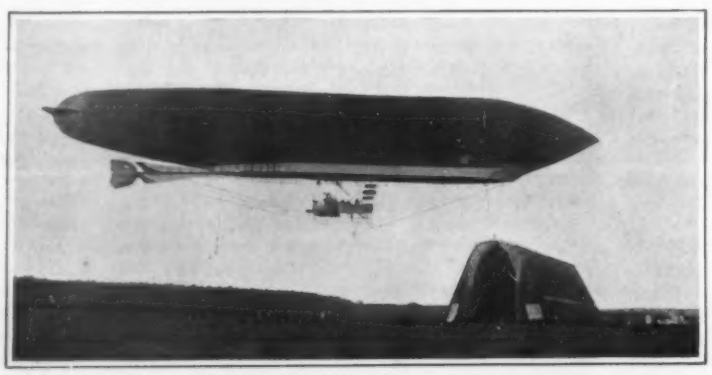
The scale on which this reorganization is being carried out, is best seen in the docks and harbors provided for them. To the only two hangars that were over 400 feet long, at Issy and Moissons, there are now being added two at Verdun and one each at Belfort, Epinal, and Toul. Further sheds, similar to the existing ones, are planned for at Mezières, Montaigne, camp of Chalons and Langres. These will all be over 400 feet long and so arranged that they may be lengthened to 600 feet. Each is to accommodate two big dirigibles. There are special hydrogen factories in Paris, Lille, Langres, Montfort, Beauval and La Motte Breuil, the last named with a capacity of 360,000 cubic feet per day. A similar one will be built in the camp of Chalons.

The first squadron of the new fleet has just been completed with the going into commission of the "Lieutenant Selle de Beauchamp." The other ships are "Capitaine Marechal," "Adjutant Vincenot," "Adjutant Reau." They are all named in commemoration of the brave officers who perished with the ill-fated "Republique." Their type is a clever development of the old "Lebaudy" and "Ville de Paris," the "Adjutant Vincenot" and "Adjutant Reau" being patterned after the "Ville de Paris" of the classical La France type, while the two others are improved Lebaudys. With about 250,000 cubic feet displacement, 270 feet length, 38 feet beam and two motors of 80 horse-power each, these are the smaller of the four, but in point of fact the most interesting, as the Lebaudy type, with its single short car, does not lend itself so readily to enlargement, from the engineering point of view.

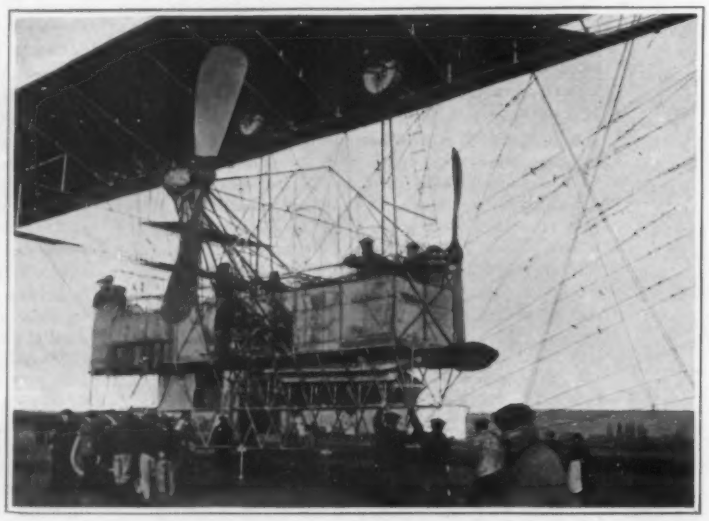
The main outlines are strictly of the Lebaudy type, but in the "Lieutenant Selle de Beauchamp" essential differences are to be seen in the suppression of the vertical stabilizing fin at the extreme stern, which is replaced by fixed surfaces forming part of the vertical rudders. All rudder surfaces are doubled. This feature is copied from all very large airships, and means saving of weight. Part of the horizontal rudder planes are nearly amidships, where they act less as rudders than as true aeroplanes, lifting (or depressing) the ship at an even keel. There are two large air-ballonets, and two blowers of great capacity, mounted next to the envelope, and driven by long transmission. Their doubling means increased safety. The deep trussing under the car gives great strength to the whole ship, but at the same time, together with the maze of equally exposed suspension ropes and the complicated outriggers for the propellers, causes much air resistance. The car is spacious and comfortably arranged.



Car of the "Beauchamp."



The "Lieutenant Selle de Beauchamp" in flight.



Bottom of the balloon and car of the "Beauchamp."

RECENT DEVELOPMENTS IN FRENCH DIRIGIBLES

Despite the remarkable progress that France has made, Count Henri de la Vaulx seems to fear that the German rigid type is fast out-distancing the French type. In an interview recently published in the Paris *Matin* he states that a year ago the Zeppelins could not rise high enough to be dangerous from a military point of view, but that the type can now ascend to 6,500 feet and carry a much greater weight than the French non-rigid balloon. With a radius of action of over 600 miles, a nice regulation of ascent and descent, he believes it would not be impossible for a German fleet to spread panic in towns and villages by dropping explosives and to transmit valuable information to headquarters by means of wireless.

Utilizing the Nile Sudd

IT has been discovered that the *sudd* (otherwise written *sadd*), the impenetrable mass of vegetation that obstructs the White Nile, and which has heretofore been regarded not only as useless, but as a most serious obstacle to the development of the Egyptian Sudan, can be readily converted into fuel by a briquetting process. Further particulars concerning the development of this interesting discovery are now available. The Sudan government has granted a concession, conferring a monopoly for the manufacture of solid fuel from the sudd for a period of 17 years. The concessionaires have been given the exclusive right to cut sudd over the first 93 miles of the Bahr el Jebel, starting from Lake No, and a further site of 25 acres is granted for the purpose of erecting a factory. The contract stipulates that the needs of the government services shall be supplied in preference to private consumers, and prescribes a minimum output of 25,000 tons per annum, though it is expected that double this amount will be produced. The government is also to receive a rebate of 10 per cent on the price to others, and a rent of $1,250 per annum, or a commission of 5 per cent on the net profits, whichever shall be greater.

Thus a new chapter is about to be written in the curious history of the sudd. There is still much uncertainty as to whether sudd occurred in the Nile prior to the middle of the 19th century. Two Roman centurions, sent by Nero to explore the river, reported that they were stopped by an impassable marsh, which was probably the growth now known as the sudd. On the other hand, when the stream above the Sobat was first reached by modern explorers, in 1840, it was clear of sudd, and so remained until 1863; and according to Marno the natives of the present sudd district have no traditional knowledge of any such obstructions before that period. However, as has been pointed out by Capt. Lyons, the natives easily traverse the narrow channels of the marshes in their light canoes or on rafts, and the blocking of the main channel would be of no importance to them.

The sudd blocks are so dense and so elastic that steamers have no effect upon them, and they are tenacious enough to support the weight of cattle. The river is unable to break its way through, and spreads in wide lagoons.

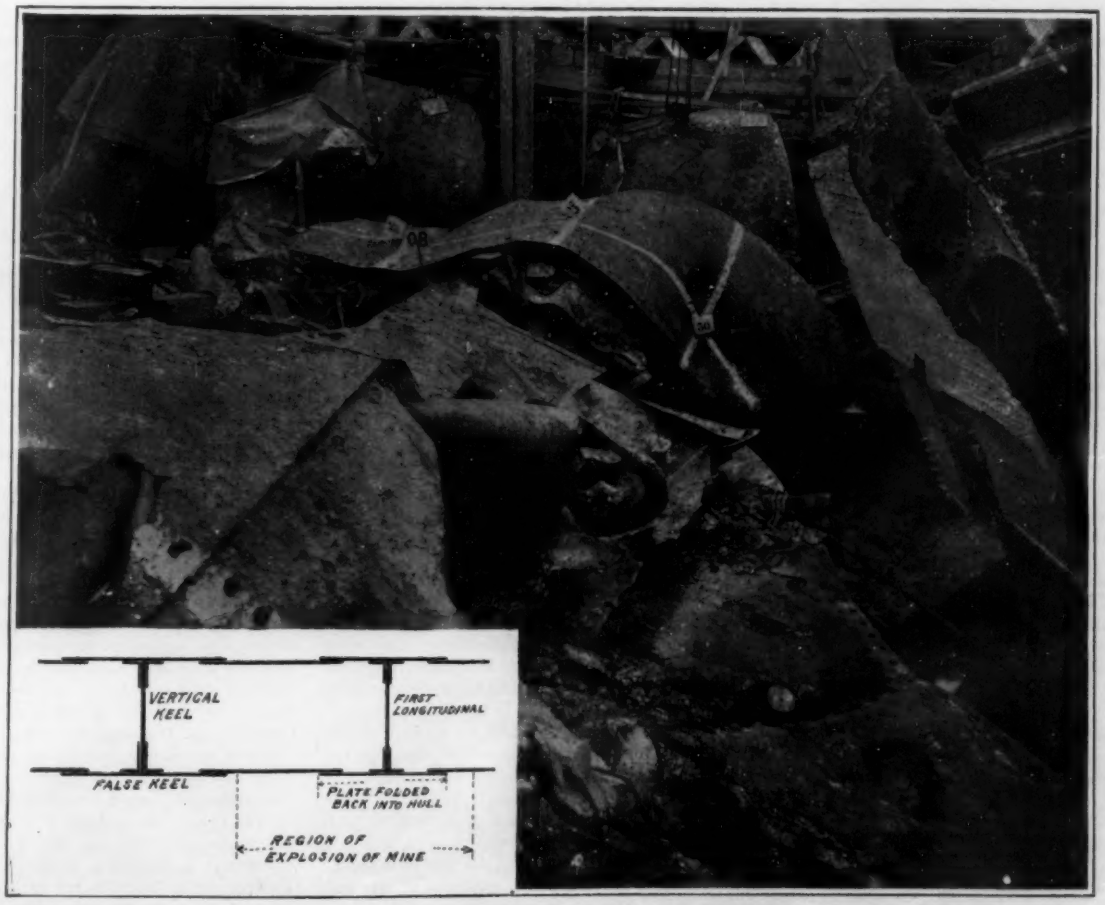
Baker, in 1870, had to cut his way through 50 miles of sudd in his passage to Gondokoro. Under Ismail Khedive the White Nile was successfully reopened, and was clear for large vessels when Gordon reached Khartum in 1874; but by 1878 the Bahr el Jebel was again blocked. The Egyptian government waged a continual battle against the sudd. Often the growth was found to have reached the stage where the river was completely obliterated. The stream was not definitely cleared and opened to navigation between Khartum and Gondokoro until 1904, since which time the sudd has been kept under control.

"Maine" Explosion No Longer a Mystery

AN incurved bottom plate proves an outside explosion. When the unwatering of the "Maine" commenced, and the level had been sufficiently reduced to expose the greater part of the vessel, there was revealed at the seat of the explosion such an absolute destruction of the hull that the army engineers in charge believed it would be impossible to locate the exact point at which the explosion started. The determination of Congress, however, to investigate every scrap of the hull that could be brought to light, and the voting of liberal appropriations for this purpose, have been rewarded by the discovery, and the establishment beyond all question of doubt, of the exact point at which some enemy from the outside struck the fatal blow.

So strangely torn asunder and twisted out of its original position was the material of the hull, that evidently only a naval constructor familiar with every detail of the construction could have hoped to piece the thing together and identify the individual sections. This work was intrusted to Naval Constructor W. B. Ferguson, to whose indefatigable labors is due the collection and orderly arrangement of a mass of concrete evidence, which proves that the "Maine" was blown up intentionally by some person or persons who placed a charge of low explosive against the outside of the hull of the ship. By the courtesy of the Department, we show a photograph of the bottom of the ship at the immediate scene of the explosion of the mine. What the mine was can only be conjectured. It may have been of the crudest construction. An ordinary barrel, say of the size of a sugar barrel, loaded with black powder and with a few glass tubes filled with the proper materials for igniting the powder, projecting from it, the barrel being provided with a length of rope and an anchor, would have been quite sufficient. The depth of the water was known, as was probably the draft of the "Maine;" and the anchoring rope could have been made of sufficient length to cause the ship, in swinging, to come into contact with the mine. On a dark night the placing of such a mine would be a simple matter, for a fishing boat, sailing by the "Maine," could have let the mine go from its stern without much danger of detection.

Whatever the method, it is now certain that the mine came in contact with the bottom of the "Maine" at a point immediately below the first longitudinal on the port side of the central vertical keel. Had it contained a high explosive, a clean hole would have been cut through the bottom immediately over the mine. But being filled with a low explosive, probably black powder, the blow was distributed over a rather wide area, say, some 200 square feet, which was dished upwardly, from one to two feet, while the plate immediately above the mine was torn loose from the adjoining plating and blown inwardly and to the rear until it was folded back in the tell-tale position shown in the accompanying engraving. Immediately above this plate was the 6-inch magazine, in which was some black powder in cases, used for saluting purposes. The heat of the inrushing gases was sufficient to ignite this powder, which, in turn, set off practically the whole of the forward magazines. The testimony of survivors was practically unanimous that two explosions occurred within a fraction of a second of each other—the first muffled, the second louder and more powerful. It is needless to expatiate upon the evidence thus presented.



This view is taken on the outer shell of the double bottom, looking forward. The keel lies about the center of the picture. To the right is the strake of bottom plating which was blown in and back by a mine placed outside the ship.

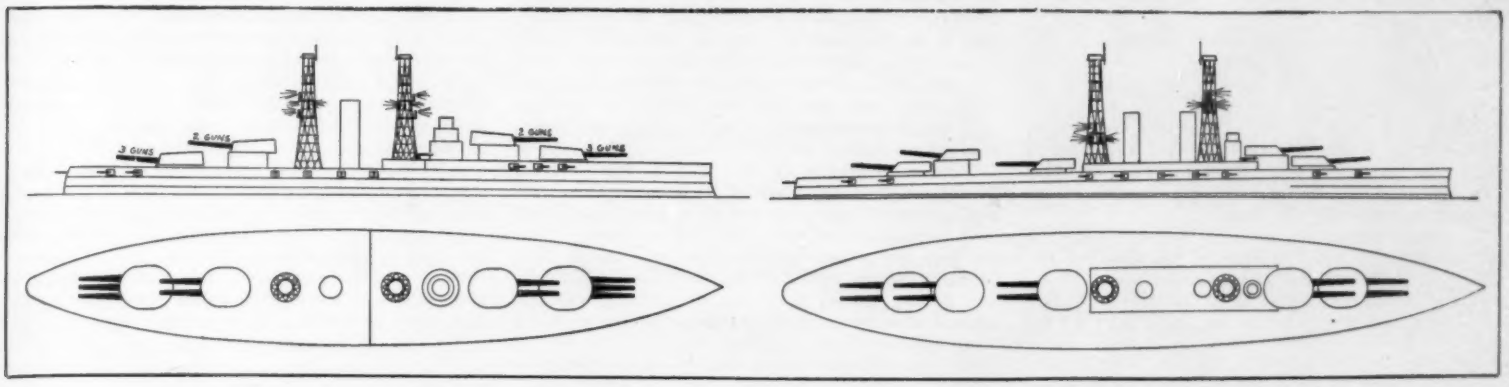
VIEW OF THE FLOOR OF THE "MAINE," AFTER REMOVAL OF WATER AND MUD

The Three-gun Turrets of the New Battleships

THE announcement that the plans for the new battleships "Nevada" and "Oklahoma" contemplate not only the use of the new 14-inch 45-caliber guns, but the installation of part of them in three-gun turrets, cannot help but arouse speculation as to the considerations that induced this radical departure from accepted standards in turret gun-mounting. The three-gun arrangement should not be compared with the discarded superposed turret of the type installed on the "Kentucky" and "Virginia" classes. On these ships a turret with two 8-inch guns was superposed on each 12-inch turret. The defects of this arrangement were the interference of the fire of the 8-inch guns with the aiming and firing of the more important 12-inch guns, except when all were fired in salvo, and the fact that the fall of the 8-inch shot cannot be distinguished by the spotters from that of the 12-inch. As the ballistic properties of the guns are different, their ranges must be corrected independently. This latter consideration is one of the main arguments for the all-big-gun battleship, in which 8-inch guns have been discarded.

The all-big-gun ship, with the turrets on the center line, undoubtedly has come to stay, at least until some development in tactics or torpedo firing compels a change in the present fleet battle formation. With four turrets, this center line arrangement gives the maximum efficiency for each turret, and additional turrets do not give a corresponding increase in fire and handiness. This is due to the fact that the fifth and sixth turrets cannot be installed high enough to fire over the tops of the others and they have, therefore, a large "dead arc." Also, because of the necessity for their location amidships, the magazines come in proximity to the boilers, and high temperatures result, which involve complicated installations for magazine insulation and refrigeration.

Thus it is apparent that it is advantageous to mount the main-battery guns in



The "Nevada" and "Oklahoma."

Length, 583 feet. **Beam,** 95 feet 2 ½ inches. **Displacement,** 27,500 tons. **Speed,** 20.5 knots. **Armament:** ten 14-inch, twenty-one 5-inch.

The "New York" and "Texas."

Length, 573 feet. **Beam,** 95 feet 2 ½ inches. **Displacement,** 27,000 tons. **Speed,** 21 knots. **Armament:** ten 14-inch, twenty-one 5-inch.

THE THREE-GUN TURRETS OF THE NEW BATTLESHIPS

four turrets, rather than in five or six. With four double turrets, eight guns is the limit; while with three-gun turrets, or a combination of double and three-gun turrets, it becomes possible to install twelve or ten main battery guns on a four-turret ship. As the "Texas" and "New York," which directly precede the "Nevada" and "Oklahoma," have ten 12-inch guns in five turrets, the authorities were constrained to provide for at least as many on the latter ships, and an arrangement of two three-gun and two two-gun turrets was adopted, the double turrets firing over the tops of the three-gun turrets.

Another consideration that affects the three-gun turrets is the possibility they offer for firing in salvo, or simultaneously, all of the guns of one caliber in the ship. The advantage of this comes from the facility it offers in spotting the fall of the shot and judging the center of impact, in order to correct the range at which the sights are set. When the guns are fired singly, wild shots may be given undue weight by the spotters in correcting the range.

All things deliberated, the main consideration, and the one that, no doubt, brought in the three-gun turrets, just as it did the all-big-gun-battleship, is the question of spotting. This is of the greatest importance in determining whether the shots shall hit the target, and the facility and accuracy with which it is done and the shots brought on the target will be large factors in determining the result of future naval engagements. Another obvious advantage of salvo firing is the possibility it offers of increasing the fire, by eliminating delays caused by the interference of guns, when fired independently, with the sighting and firing of the other guns.

Under conditions as they are understood now, concentration of fire on the enemy's ship as early as possible in the engagement is of the first importance, it being generally a foregone conclusion that the ship which gets in the first salvo will win the engagement, simply because the enemy's vessel will be disabled. The rapidity with which successive salvos are delivered and hits made, when the range has been found, may prevent the enemy from delivering in reply even a single broadside with accuracy.

Thus, concentration of the gun fire is of supreme importance, and this depends to a great extent on the number of guns that can be controlled and fired with a minimum of effort and risk of error. When the guns are pointed independently, even though fired in salvo, concentration is rendered more difficult by the greater chance for error in pointing, and the greater difficulty in spotting and setting the sights to the ranges as determined, which must be adjusted separately in each gun.

It is obvious, therefore, that in order to obtain the maximum efficiency from the three-gun turret, all the guns of each turret should be capable of being pointed as well as trained simultaneously, as one gun, that is, they should be fitted with a single elevating gear. There is of course the possibility that, in firing, there may be an interval between the actual time of discharge due to slower ignition of their powder charges, and the aim of the last gun firing would be thrown out by the shock of recoil of the other guns. Another valid objection to the three-gun turret is the greater loss consequent upon disabling such a turret.

The United States Navy is not by any means a pioneer in this field, as the Italians have laid down two classes of ships having the three-gun turrets; one type having three three-gun turrets and two double turrets, while the other has four three-gun turrets. Also, the Russians and the Austrians have laid down battleships having four three-gun turrets.

The foreign navies, it is understood, propose to fit the guns in their three-gun turrets, so that each is elevated and fired separately, as is at present the case in the double turrets, thereby failing to take full advantage of the possibilities the new turrets offer.

A Difficult Engineering Feat Carried Out in Paris

Piercing the Montmartre Hill for a Subway

An engineering enterprise presenting somewhat unusual difficulties is nearing its completion in the great French capital. The Nord-Sud Railway, which at present has its terminal at the Place Pigalle, is to be continued through the Place des Abbesses, Rue Lamarck, the Place Jules-Joffrin, to the Porte de la Chapelle, the northern terminus.

To establish this communication the hill bearing the name of Montmartre will be pierced through and through. Because of the past history of the ground traversed, the tunneling operations are of a peculiarly delicate nature.

The geology of the hill can be gathered from the sectional view which accompanies this article. The strata include layers of gypsum, which in the past were exploited for the production of plaster of paris, causing the territory to become honeycombed with galleries. When the work was abandoned the surface workings were filled up with refuse, and the deeper galleries were for the most part left just as they were, with the natural pillars as their only support.

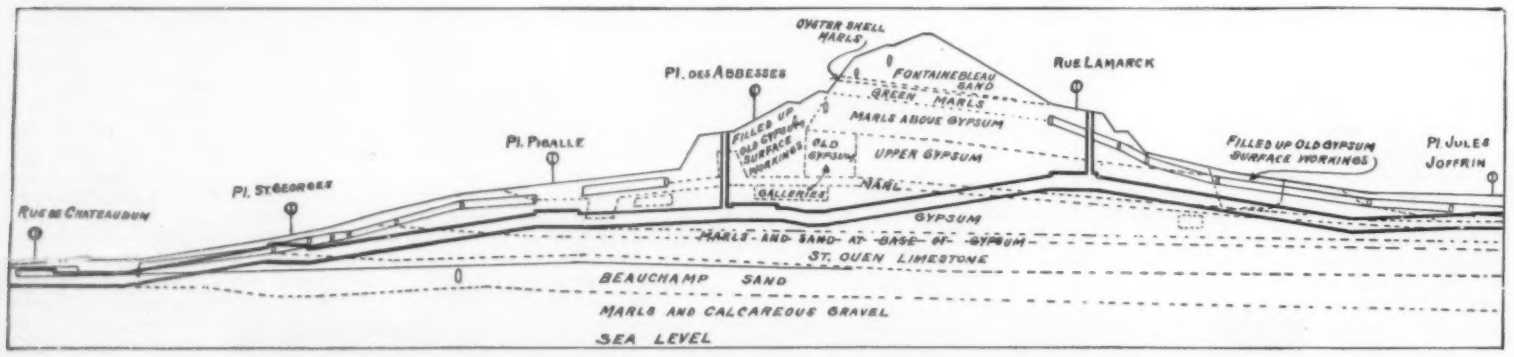
Over this honeycombed territory buildings have risen, and it was an extremely delicate operation so to build the new tunnel as to preclude any possibility of accidents to the superstructures through the giving way of the old gypsum mines.

The plan finally adopted was essentially to run the tunnel below the level of the gypsum workings, and this has been done so far without any serious mishaps. The general outline of the tunnel will be seen sketched in the geological profile section which has already been referred to.

A somewhat detailed account of the plan followed in carrying on the work is given in *L'Illustration*, from which we have derived most of our data.

Up to the Place Pigalle the construction of the subway followed the usual lines, there being no abnormal features to contend with. From this point on the subway enters the narrow passage of the Elysée des Beaux Arts, all the buildings of which are more or less traversed with fissures, and are ready to collapse at the smallest provocation. This is the site of the old surface-worked gypsum mine, and here it became necessary to depart from common practice and follow some special methods.

Two shafts lined with masonry were sunk. Starting from each shaft a cutting was made, in which was immediately built a masonry lining, in 5¼-foot lengths, which followed the elliptical outline of the vault, the two sections meeting at the keystone. It was necessary to use special steel casing here instead of the usual wooden supports. As soon as one ring was completed the next one was put in place, and so on. Lastly, in order to consolidate the overlying material, cement was forced in through holes provided for that purpose in the vaulting. A special precaution taken in carrying out this step was to force in a blast of compressed air before injecting the cement. This was found most effective, and in several places it was observed that the cement injected extended through cracks and fissures as far as 65 feet from the point of application.



Section through Montmartre showing geological strata and course of travel.

The subway passes through under the Place des Abbesses and proceeds as far as the Place Constantin Pecqueur. Here the tunnel passes within not many feet of the old gypsum workings, which are now more or less filled with water. It may be mentioned incidentally that it is this ground water which, in 1886, caused the collapse of a building in the Rue D'Orchamp. The floor of the gypsum galleries is formed of marl. If this thin layer of rock, saturated with water as it is, gives way, a trough is formed, the effect of which may extend as far as the surface soil. This was the condition which threatened the construction of the vault of the Place des Abbesses. Here again the common methods of working were impracticable, and the processes employed under the passage of the Elysées des Beaux Arts were adopted. The vault here rises 4.92 feet above the level of the rails, and the masonry at the keystone measures 4.1 feet in thickness.

Special conditions were also met at several of the points along the line, as, for instance, at the Rue Ordener, where there are no gypsum galleries, but a peculiar soil was encountered. Here it was found necessary to drive a large number of oak piles, to give rigidity to the soil.

The stations Abbesses and Lamarck are situated at a depth of 98 and 56 feet below the ground level, so that it was necessary at these points to sink large shafts, 23 feet in diameter, to give access to the platforms. One of these shafts, which accommodates the elevators, has been sunk by the side of the station. The other, in which the staircases will be contained, rises directly above the vault of the station. The stairs are intended merely for emergency use in case the elevators should give out. The tops of the shafts are closed and access is gained to them laterally through the staircases leading from the street

Waiting rooms adjoin the elevator shafts. There are two levels, and accordingly two stations at which the elevator stops. This and other features of the installation will be better understood by reference to the accompanying illustrations.

The elevators are formed in the shape of trapezoids, the large base measuring 18.9 feet and the small base 10.7 feet, the distance between the two being 6.7 feet.

Each elevator is actuated by a 120-horse-power electric motor, and the two cars will be run in alternation, one ascending while the other is descending, the speed being 2.62 feet per second. This means that the time taken for passengers to reach the platform will not exceed two minutes. Each elevator accommodates eighty persons. It will be seen, therefore, that provision is made for extremely rapid handling of the traffic.

The construction of the shafts presented great difficulties owing to their depth and large diameter. They were sunk in installments, 6.6 feet at a time. Each was faced with reinforced concrete in which were imbedded vertical iron rods, which served for the attachment of the next lower ring.

It will be seen from our diagram that the geological strata of the Montmartre hill form nearly horizontal layers, with somewhat greater inclination toward Paris from the Place des Abbesses on. Some of the geological facts brought out in the course of this work will no doubt prove valuable in the execution of other building operations in the neighborhood.

Those of us who have seen the New York subway come into being, who have become so accustomed to the new means of transit that they find it difficult to think of our great city making shift without it but a few years ago, and who are now watching the extensions under way in Brooklyn, will note with interest how the French capital is grappling with a problem of its own, a problem presenting some peculiar difficulties unlike those which the builders of our New York subway had to face. How little the host of travelers through these tunnels realize and appreciate the engineering skill to which they owe their safety and comfort.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Canal Tolls

To the Editor of the SCIENTIFIC AMERICAN:

There is so much discussion nowadays of the present condition of the American merchant marine that I cannot resist the temptation to express myself, even though it be only to a wastebasket.

To begin with, let me confess that the largest body of water I ever saw is Lake Michigan, and only a very small part of that; but I have a suggestion to make that I think might prove worthy of consideration.

It has been suggested that all shipping between Atlantic and Pacific ports of the United States should be classed as coastwise shipping, and that this with the opening of the Panama canal will solve the problem. Others claim that preferential tariffs are the only real solution.

Now I have two more suggestions to add.

First: Preferential tolls at Panama. Make foreign-owned ships pay heavier tolls, and the American can then at least divide the South American trade.

Second: The Philippine trade is at present, I believe, classed as foreign. Why not let the imports from these possessions in on a free trade basis, provided they were carried in American bottoms? This would accomplish the three-fold purpose of increasing American shipping in the Pacific, increasing our Philippine trade, and thereby, thirdly, draw the islands into closer relations with the mainland—a thing most ardently to be desired. I should like to hear what others think of these suggestions.

Manhattan, Kans. H. H. MUNGER.

Stereoscopic Effects Without Apparatus

To the Editor of the SCIENTIFIC AMERICAN:

Several years ago I made the pleasing discovery that in viewing objects or pictures it is possible to obtain stereoscopic effects without the use of any stereoscopic apparatus

Take two pictures, that are precisely alike, say two cabinet photographs from the same negative, and toned to the same color. Stand them up on a table, in parallel, and twelve or fifteen inches apart, from center to center. The experiment, now, is to stand about four feet from them, and look at the left-hand photograph with your right eye, and the right-hand one with the left eye. To do this, one must cross his eyes, which is really not painful nor injurious to the eyes. To aid in this as a beginning, put up the tip end of your forefinger on a line with the pictures eight or ten inches from your eyes. Focusing your eyes on the end of the finger, you will see the two unfocused and blurred pictures—the right-hand one with the left eye and the left with the right eye. Continue to keep the eyes focused on tip of the finger simply for control of the focus, and at the same time notice the two background images. They are wavering and unsteady, but just move the finger backward or forward until the two unfocused back images of the photos fall together and are blended into one picture. Right here the eyes are very treacherous, and the focus at the finger tip is hard to hold. But persist in the effort, and it will finally become easy, so that the finger can be gently removed and leave the eyes still focused where the finger was.

Then, if your effort is successful, there will appear three images, but keep your attention firmly fixed on the one in the center, when it will appear in all its rounded beauty, and firmly fixed in space only a few inches from your eyes, or at the point where the lines of vision cross each other from the two eyes, as in this diagram:

Stereoscopic effects obtained without a stereoscope.

This needs very little explanation. The two dots are the eyes; the two right-hand cards are the real photographs, but lose their reality when the third one in the center appears. The picture thus formed is quite fascinating as well as perfect, and with a little practice one can so train his eyes as not to need the tip of the finger at all.

Not long ago there appeared in the SCIENTIFIC AMERICAN a stereographic view of Brook's comet. I cannot tell what great and awe-inspiring delight it afforded me to look at that picture in the way described above, without the use of a stereoscope. The comet did not appear on the surface of the paper, but far away in the depths of star space. The grandeur and beauty of that picture was lost to many thousands because a stereoscope was not convenient.

Gulfport, Miss. R. W. CARLETON.

Astronomical Observatory on Mount Everest

To the Editor of the SCIENTIFIC AMERICAN:

Why not establish an astronomical observatory above the troublesome lower strata of atmosphere, that plays such havoc with the "seeing?" True, we have mounts Low and Wilson, and Flagstaff, but these are in comparatively low altitudes, compared with the world's high places, like Everest and Dwalgiri in India, Kilima-Njaro in Africa, the Schreckhorn and Finsteraarhorn in Europe, Illimani, Sorata, and Sahama in South America, and Shasta, Ranier, McKinley, and others in North America, the peaks of which would lift our instruments high enough above the earth to practically eliminate the atmospheric troubles we have to contend with at lower levels, practically doubling the powers of our present instruments without any increase in size, which has apparently been nearly, if not quite, reached.

I believe it not only possible, but feasible, to utilize these "high places" for astronomical bases, chimerical as it may appear at first blush. Let us choose Everest for example. We would establish a permanent settlement at as high an altitude as could be endured without especial discomfort, building commodious residences for our staff of observers, houses for workmen, power houses, etc., using hydro-electric plans if water is available.

We would then attack the real problem (reaching the summit) by means of a tunnel, rising on easy gradients, by means of spirals or switchbacks, lining the tunnel wherever necessary, and keeping a good constant air pressure on the workings, heating and lighting them from the power house below. The summit attained, we would form the observatory within the summit, lining it if necessary, placing our revolving roof in position, its edges level with the summit itself. The difference in air pressure, inside and outside, would practically "float" the roof, and the problems connected with the practical installation of the instruments could be successfully coped with by our engineers. The pressure constants, inside and out, would be practically uniform, and should make no trouble in working out details. The temperature of objectives could be kept uniform, preventing precipitation of moisture on them; the eyepieces could be subjected to local refrigeration for the same purpose, if necessary.

Such outside work at the summit as was necessary would be reached by the aid of a suitable air-lock, the workman using an oxygen helmet while engaged in outside work. Suitable air locks would be installed at the foot of the tunnel if necessary, and the tunnel would be equipped with electric motive power for the rapid transit of passengers to and from the observatory.

I firmly believe this plan can be carried out, by our present-day engineer. I am certain that he will drive a tunnel successfully, anywhere it is wanted, if sufficient funds are available for the purpose. The problems involve no new principle, except in application.

Four such observatories, one in Asia, one in Europe, one in South America, one in North America, all connected by cable, equipped with the best modern means of instant communication with each other and with existing surface observatories, capable of swinging their powerful instruments to a common point as quickly as the gun pointers on a battleship aim their various guns at the target, could not but produce results hitherto unattainable and undreamed of. The thought itself is inspiring.

Now as to the funds necessary to carry to completion a work of such magnitude. The world would be "no worse off" if the entire "Dreadnought" programme of the leading powers was suspended for a few years and the funds diverted to this work. England, France, Germany, and the United States, working in concert, could furnish funds for the whole work, as outlined, in two or three years at most, and no smaller power could "catch up" in that time enough to menace the "balance of power." The existing status of none of the nations involved would be changed by the cessation of battleship building, and the results obtained by such a chain of observatories would be of infinitely more value to the inhabitants of our planet than any fleet that ever sailed the seas, and the stations themselves would be imperishable monuments to the grandeur of human intellect and endeavor long after battleships are regarded as relics of a prehistoric age of savagery.

One law of the universe discovered, one truth made plain, one idea evolved and proven to be good for humanity, would amply repay all the expenditure.

Green Cove Springs, Fla. VICTOR D. EDELY.

Rules Governing the Competition for the $15,000 Flying Machine Prize Offered by Mr. Edwin Gould

1. A PRIZE of $15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together.

Conditions of Entry.

2. Competitors for the prize must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the GOULD-SCIENTIFIC AMERICAN Prize, 361 Broadway, New York city. Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, helicopter, etc.), give its principal dimensions, the number and size of its motors and propellers, its horse-power, fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the office of the SCIENTIFIC AMERICAN on or before June 1st, 1912. Contests will take place July 4th, 1912, and following days. At least two machines must be entered in the contest or the prize will not be awarded.

Contest Committee.

4. The committee will consist of a representative of the SCIENTIFIC AMERICAN, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

Conditions of the Test.

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be allowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and together. Recording tachometers attached to the motors can probably be used to prove such performance.

In the judging of the performances of the various machines, the questions of stability, ease or control and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions shall be awarded the prize.

6. All heavier-than-air machines of any type whatever—aeroplanes, helicopters, ornithopters, etc.—shall be entitled to compete for the prize, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

7. The flights will be made under reasonable conditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.

8. No entry fee will be charged, but the contestant must pay for the transportation of his machine to and from the field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced or or about June 1st, 1912.

10. Mr. Edwin Gould, Munn & Co., Inc., publishers of the SCIENTIFIC AMERICAN, and the judges who will be selected to pass upon machines, are not to be held responsible for any accident which may occur in storing or demonstrating the machines on the testing ground.

The First Trans-continental Railway in South America, from the Atlantic to the Pacific

The Transandine Railway and Tunnel

By F. C. Coleman

AFTER nearly thirty-five years of almost continued effort and disappointing and arduous work, the great railway enterprise for connecting the republics of Chile and Argentina has recently been brought to a successful completion. This engineering feat is one which will rank among the most remarkable achievements of the world. It is the first trans-continental railway line in South America, from the Atlantic to the Pacific, and forms one of the four outlets by which Chile, separated completely by the natural formation of the territory from most of her sister republics, will be able to communicate freely and at all times of the year with the world at large. The inception of the Transandine line dates back to 1872, when Messrs. Juan and Matteo Clark secured a concession from the Argentine government for the building of a railway from Buenos Ayres to Mendoza and the Argentine boundary, and shortly afterward a concession from the Chilian government for a line from Los Andes to the Chilian boundary. The line to Mendoza was finished in 1886, and in January, 1887, the construction of the extension toward the Chilian frontier was taken in hand. The line reached Punta de Oacas in 1893. The Chilian section of the Transandine railway, the total length of which from the frontier to Los Andes is 43.8 miles, was started in April, 1889. Natural obstacles and other defects intervened so continually in the construction of the Argentine section of the line from Mendoza to Uspallata, that in the opinion of several eminent engineers the further progress of the railway was considered to be very improbable, although not scientifically impossible. The construction work in many parts proved to be of a very heavy nature, necessitating elaborate work in cuttings both in gravel and rock, and extensive defenses to protect the line against river floods. The most serious engineering work was in the portion of the route leading up to La Cumbre Pass, where the Cordillera Mountains have been pierced by a series of difficult tunnels and the Abt system of cogs and racks employed for the safe and expeditious running of trains. On the Chilian side of the Andes the construction of the line has proved hardly less difficult and quite as costly. The construction was divided into three sections, the first of which, from Los Andes to Juncal, a distance of 32 miles, was opened for traffic in February, 1906. From Los Andes to Rio Blanco, a distance of 21 miles, the grade does not exceed 2.5 per cent, but from that point onward the grade becomes increasingly severe, running as high as 8 per cent. From Rio Blanco to Juncal, a distance of 10 miles, the engineering problems encountered were of less moment. Between Rio Blanco and a point 10 miles therefrom the line rises 2,696 feet. The minimum curves are 485 feet, but there are only two of this radius, all the others being of 649 feet or over.

Between Los Andes and Rio Blanco there are four 65-foot bridges in addition to seventy-nine of minor dimensions. Between Rio Blanco and Juncal there are two bridges of 65 feet span, one of 97 feet span, and thirty-two of smaller dimensions. On this section there are also three avalanche sheds to protect the trains from the enormous masses of snow, which, as is the case on the Canadian Pacific Railway, collect upon the side and are frequently precipitated upon the line. Section two is that between Juncal and Portillo, which lies in an exceptionally mountainous and wild district. This second section of the Transandine Railway was opened in June, 1908, well within the specified time. It is, however, in the last part of the third section, viz., that from Los Andes to La Cumbre, or the dividing line between Chile and Argentina, that the great [illegible]l tunnel, perhaps one of the longest of its kind and most difficult of construction in the world, has been made. The summit tunnel has a length of 9,906 feet, and in addition there are short lengths of artificial tunnel at each end, viz., 105 feet on the Chilian side and 338 feet on the Argentine side. The Transandine tunnel lies at an elevation of about 10,500 feet, nearly 1,500 feet higher than the highest carriage road in Europe, that over the Stelvio Pass, and more than 3,500 feet higher than Mont Cenis, St. Gothard and Simplon passes. In cross section the tunnel is a replica of the Simplon tunnel, the internal area inside the lining being 273 square feet. This large section has caused great controversy. The conditions of the concession would have been complied with by a tunnel having an internal area of 173 square feet. The larger section was doubtless decided on with the object of providing efficient ventilation; but when it is considered that the modern tendency is to work the traffic through long tunnels by means of electric traction, and that the position of the tunnel is at the end of a long narrow valley, with a prevailing wind from west to east, the objectors to the large section seem to have had strong grounds for their argument. There is already a proposal for the electrification of some of the Chilian state railways, and the natural facilities available point to the electrification of the Transandine railway within a few years.

The rock on the Chilian side was of a much more uniform character than that on the Argentine side. From the tunnel entrance to about 200 feet from the boundary line the rock on the Chilian side was a hard volcanic sandstone, very much fissured with veins of felspar. Near the boundary line the rock changed to a reddish claystone, which was comparatively soft, but which gradually hardened for a distance of about 400 meters and again gradually became softer. Through it ran numerous veins of conglomerate ironstone and almost pure felspar. The rock, with the exception of the red claystone, proved very difficult to drill, the large number of joint planks tending to make the drillbits skid and jam and causing endless trouble.

The conglomerate was even worse to drill, sometimes as long as twenty hours being required to drill a round of holes in the heading on the Argentine side. Very little timber was required on the Chilian side, but at the same time continual watchfulness was necessary to guard against loose pieces coming down unexpectedly and injuring the men; where timbering was required, it was usually erected in what is known as "flying horseheads." On the Chilian side the rock from the top headings, and latterly that from the upper bench, was taken over the main bench by means of an iron chute hung from timbers placed across the tunnel at the top and bottom of the bench. The compressed-air mains were taken over the bench by flexible copper pipes. These pipes were uncoupled and carried back when the holes at the bench were fired. The whole operation of uncoupling the pipes, firing the holes, and recoupling the pipes required, on an average, three-quarters of an hour to carry out. On the Argentine side the bottom heading system did not call for these special features. As it was of paramount importance that the tunnel should be completed at the earliest possible date, an extensive plant was installed. The original plant was a compressed-air one, and was operated electrically from water-turbine installations situated at some distance from the workings. Two compressed-air locomotives, having a tractive force of 1,950 pounds, were of inestimable service in improving the ventilation of the tunnel as compared with the steam locomotives.

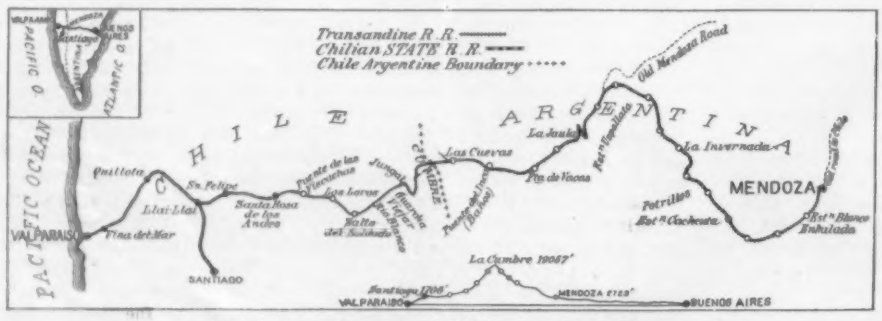
The maximum number of men employed on the Chilian side was about 640. On the Argentine side over 1,000 men were sometimes at work. This, however, was only on rare occasions, 800 to 900 being the usual number. With the exception of a few Spaniards, Italians, and Englishmen, the labor was entirely Chilian. The work was carried on in eight-hour shifts, night and day without a stop, from one month's end to the other. The only stoppage was for two days, when the headings junctioned on November 27th, 1909. The lines and levels checked-in very well and were as follows:

Difference in level..... ¾ inch.
Difference in line.....2¾ inches.

To the ordinary traveler passing near the tunnel the camps on either side must have appeared one vast area of corrugated iron. Owing to long winter and snowfall, a large amount of covered-in space was necessary for storage purposes, and the various buildings and sheds were all connected together by passages. The snowfall is by no means extraordinary, very rarely amounting to 10 feet, but owing to its light, powdery character and the fierce winds which usually rage when the snow is falling, the latter is piled up into immense drifts, often 20 feet high. In the opinion of local guides, the winters during the last three years have been comparatively mild.

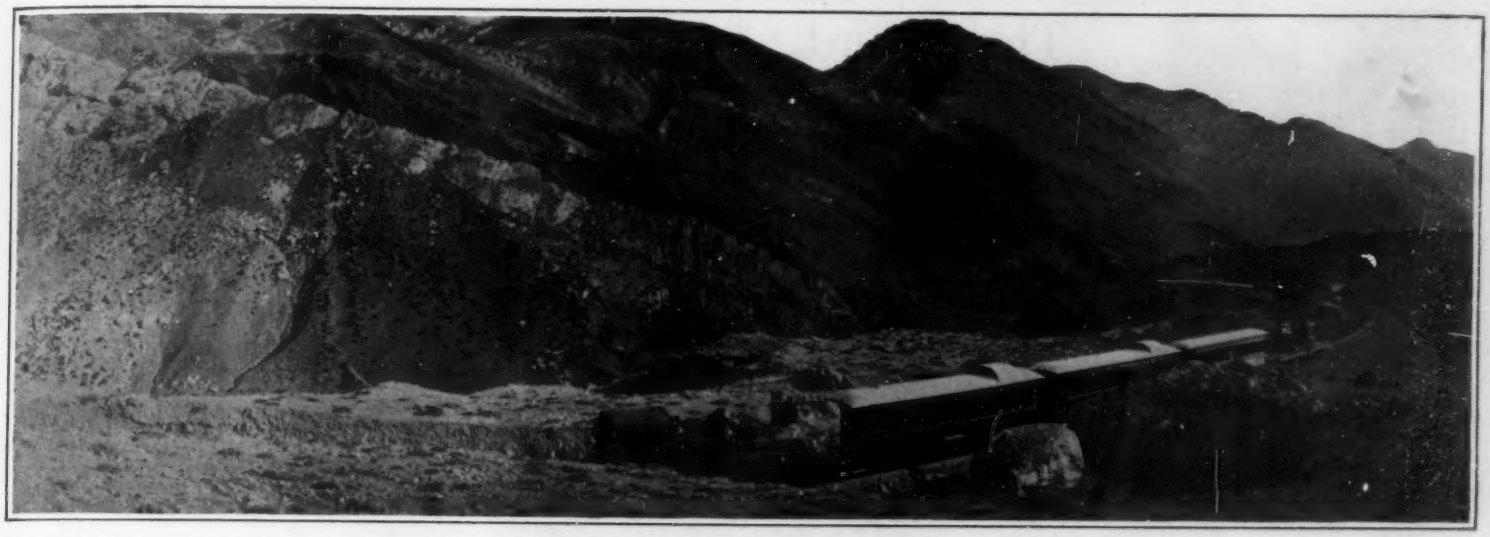
There are many who will wonder where the traffic to pay the interest on this undertaking is to come from. Much freight traffic cannot be expected, although Chile is more important than the Pacific slope was before the completion of the first trans-continental railways of North America, and there is considerable intercommunication between two countries of this importance by a route which will be for many years the shortest. The first and for some time the only link between two such countries as Chile and Argentina must necessarily find considerable traffic.

As Buenos Aires is the main gate on the Atlantic coast of this highway, so is Valparaiso the gate on the Pacific side. From this fine port steamers sail to all parts of the world. The distance to Panama is 2,610 miles, and from Colon to Plymouth 4,520 miles—a total of 7,130 miles. From Valparaiso to New Orleans, via Panama, the distance is 3,970 miles by existing lines of steamers. This brings New York very close to Buenos Aires. The west coast of South America, the Central American States, the United States of North America, Canada, and Australia, have all been brought closer together by the opening of this new trans-continental route. As regards passenger, and especially tourist traffic, much can be done with such remarkable scenery to attract visitors, not only from Argentina, but from the United States and Europe. The globe trotter, tired of India, Khartum, of the Victoria Falls, can find something quite new in the Cordilleras. The railway passes comparatively close to the Aconcagua, 23,000 feet high, and through a pass which for extraordinary formation and colorings vies with the Grand Canyon of the Colorado River in Arizona.



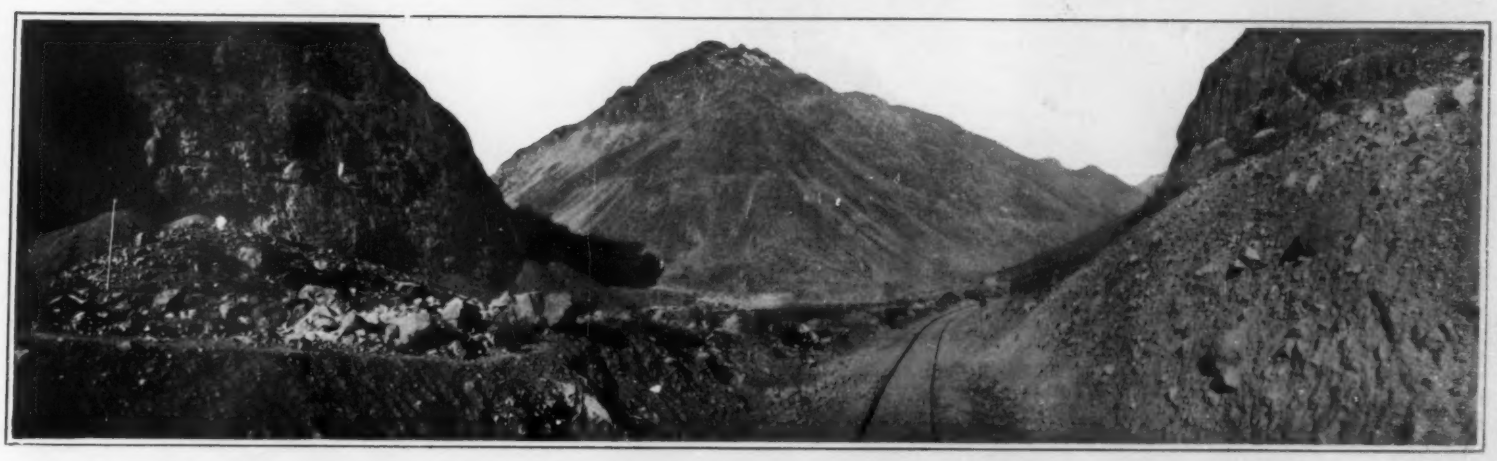
Map showing the route of the Transandine Railway.

THE FIRST TRANS-CONTINENTAL RAILWAY IN SOUTH AMERICA



View of the valley of Las Cuevas, Argentine.

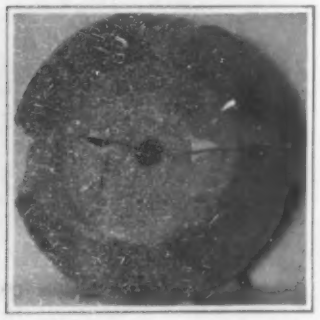
Juncal, on the Chilean side of the Transandine Road.



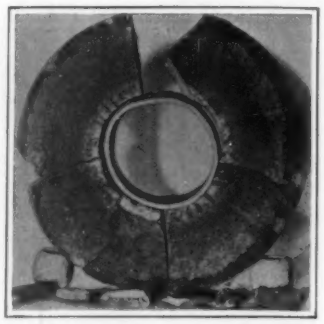
View of the Aconcagua Valley, Chile.

The small tunnel on the Chilean side, above Juncal.

THE FIRST TRANS-CONTINENTAL RAILWAY IN SOUTH AMERICA



The Third Award of the Scientific American Medal for the Conservation of Human Life and Limb



THE third bestowal of the SCIENTIFIC AMERICAN Medal was made with the usual care by the jury of awards of the American Museum of Safety on January 18th at a largely attended meeting held in the auditorium of the United Engineering Societies' building. Three medals were awarded. The Norton Company of Worcester, Mass., extensive manufacturers of grinding wheels, due to their well-developed and carefully thought out accident prevention devices, were awarded the SCIENTIFIC AMERICAN Gold Medal. The presentation speech was made by Dr. Frederick R. Hutton, and it was accepted by Mr. George N. Jeppson of the Norton Company.

Dr. Hutton said that there were in brief six criteria to guide the jury in deciding as to the acceptability of a device for this award. He spoke as follows:

"The first of these is the applicability to a wide variety of conditions or to secure safety for a large number of persons. The second is practicability. The device must be capable of being used economically and successfully and avoid intricacy or cumbrousness, which would interfere with its easy and convenient operation. The third requirement is simplicity, so that ordinary labor or supervision only shall be required to keep it in repair or operation without expert attention. The fourth principle is reliability. The apparatus or device must not fail to work in emergency. Durability is the fifth requirement. The device must neither be so delicate nor require such fineness of adjustment that it will not last in service. The final or sixth requirement is commercial availability, so that it shall be capable of being procured by those who would like to use it. It is assumed that no person owning patent rights upon a safety device will so abuse his conferred monopoly as to frustrate the actual purpose for which the device was created. On the principles of the gift and the criteria of award, the chairman of the Bureau is prepared to announce the awards for 1912 at this time.

Scientific American medal for devices for conserving human life and limb.

"The SCIENTIFIC AMERICAN Medal has been awarded to an exhibitor in the Museum, the preparation of whose exhibit for the diminution or prevention of accidents has been painstaking, complete, effective, and in every way creditable to both the designers and the installers. Visitors to the Museum will have seen the elaborate exhibit of the designers of the mountings for grinding wheels, such as are used for the polishing, grinding, sharpening of tools and other service in the machine shop and factory."

In presenting the medals the chairman spoke as follows:

"By the authority conferred by the State of New York upon the American Museum of Safety, whereby it is authorized 'to promote means and methods of safety to lessen the number of casualties and avoid the cause of physical suffering,' and as chairman of the Bureau of Award deputed by the Trustees of the Museum for this purpose, I now confer upon the Norton Company the SCIENTIFIC AMERICAN Medal of the Museum, for its splendid and illuminating exhibit in the Museum of devices to make safe the operation of the grinding processes in the shop and factory, and to all honors, emoluments, and advantages that attach to such award you are now admitted."

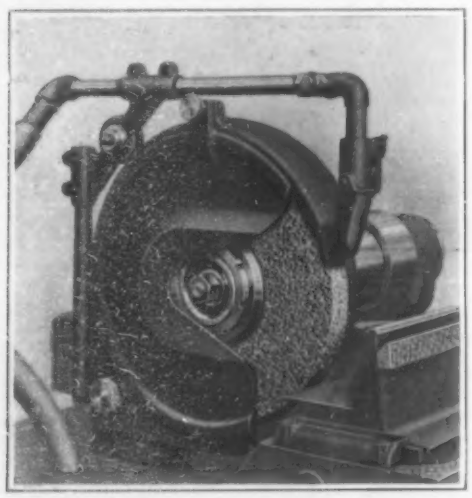
Mr. Jeppson said in reply:

"In accepting this medal for the Norton Company, we realize the high honor which has been conferred upon us by the American Museum of Safety, and we recognize the initiative and the interest of the SCIENTIFIC AMERICAN in the great work of safeguarding the American workman from the hazards of his occupation.

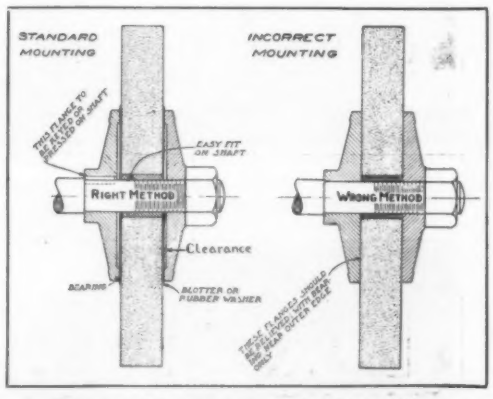
"Mr. Chairman, this medal has already given our men at Worcester a greater interest in the further and better development of the safety devices for which we have been recognized, and for them, and for our company, we thank the donors for making the award possible, and the Museum for the opportunity it has given us for assisting in their great work."

From the high speed of rotation of grinding wheels, and the fact that they are of a composite character, consisting of an aggregation of thousands of grains united by a varying bonding material, accidents have been very frequent in the past. They have been of such a serious and painful nature that industrialists have given much attention to the largely preventable causes and to minimize the effects of such accidents which may result from causes beyond human control.

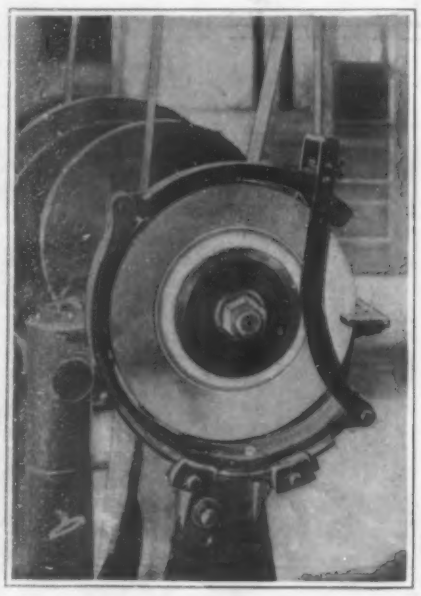
The company has at all times made an effort to fool-proof in every possible way all apparatus of its manufacture. In addition to the specially referred to safety devices, accidents from other sources have been guarded against, by means of proper housings of all gears or other pieces of mechanism, also stops which prevent the mounting of a larger wheel than the given machine has been designed for; dust suction systems for the protection of both operator and machine; leather spark brushes, so attached to the hood as to protect an operator's clothing from sparks; adjustable rests, so that at all times the rest may be brought up to the face of the wheel, preventing foreign substances from becoming wedged between the wheel and the rest, possibly causing bursting; glass shields attached to the hoods in cases where it is desired or necessary to closely watch the work, thus affording protection to the eyes, replacing goggles, which latter, however, are most generally recommended. Of



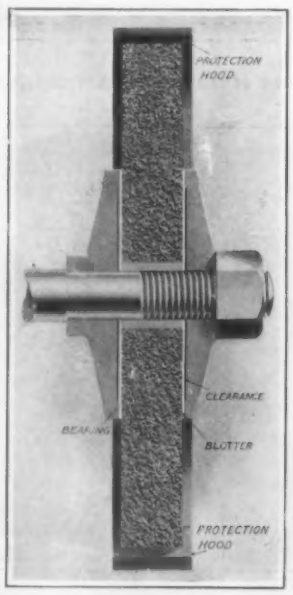
Hood for plain cylindrical grinder.



Proper and improper methods of mounting.



Early type of hood showing the fundamental idea.



Section through fully protected grinding wheel.

Grinder protected does not impair the efficiency of the machine.

THE THIRD AWARD OF THE SCIENTIFIC AMERICAN MEDAL FOR THE CONSERVATION OF HUMAN LIFE AND LIMB

(Continued on page 99.)

Curiosities of Science and Invention

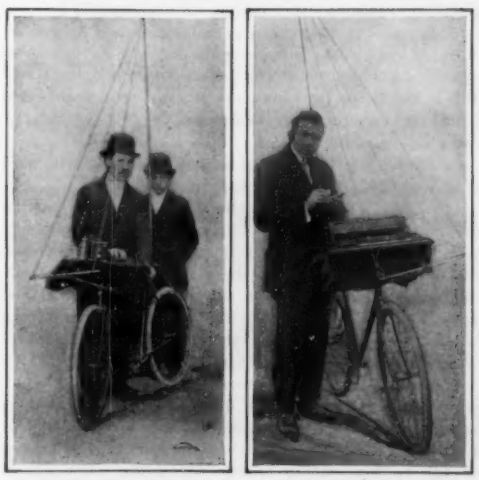
Reproducing Indian Inscriptions With Matrix Paper

THE National Museum has used an ingenious method to reproduce with absolute accuracy the inscriptions left on rocks by the Indians of the Southwest. The inscriptions are carved more or less deeply upon the smooth sides of cliffs or large boulders and a matrix paper such as is used by printers in getting impressions from type was utilized. The paper was first thoroughly wetted and then applied to the face of the rock over the inscriptions, then carefully beaten into place until every cavity in the surface was filled. This was allowed to set, then stripped off, leaving a perfect reproduction of the inscription and even the texture or grain of the rock upon the paper, although every detail was reversed. From this matrix, any number of casts can be made reproducing the image exactly as it appears in the original. These inscriptions are of great value to archæologists, and their preservation from the action of the weather and from defacement by vandals is to be commended.

Indian inscriptions reproduced with matrix paper.

Wireless Telegraphy from a Bicycle

WHILE others have been experimenting with wireless telegraph apparatus adapted for use on aeroplanes and automobiles, Mr. I. Wolff, a young inventor living in Cambridge, Mass., has been endeavoring to develop a system that can be used successfully on a bicycle. He has succeeded in maintaining communication between his own wheel and that of an associate three and one-quarter miles away. This communication was obtained without a ground, for the rubber tires insulated the apparatus completely from the earth. For an aerial, he uses three double spreads of phosphor bronze wire, each 12.5 feet long, joined in one loop at the top of a 10-foot mast, which is tied to the back of the bicycle. The sending apparatus comprises an induction-coil giving a 3-inch spark, a series of Leyden jar condensers connected in multiple, a battery secured under the instrument board, and a sending key. The receiving set comprises a tuning coil of variable inductance, a silicon detector, and a receiver wound to 2,000 ohms resistance. For the aerial, a 3-wire single spread of phosphor bronze is used. Experiments with this apparatus were conducted at night in order to avoid too much publicity. The greatest distance was obtained at the hour of 2 A. M. The assistant with the sending instrument rode ahead, sending messages as he went, while the receiver managed to keep in constant touch with him.



Receiving apparatus. Transmitting outfit.

Wireless Telegraphy from a bicycle.

An Eight-wheeled Automobile

AT first sight the accompanying photograph may give the reader the impression that the many wheeled automobile is a scheme of some unscrupulous tire manufacturer to boom his business. On second thought, however, he will realize that so far from producing greater wear of the tires, the fact that the load is distributed over eight wheels reduces the wear to less than a half on each wheel. It is seldom that the depressions in the road which give the ordinary vehicle so many bumps, are more than three feet in length. Such being the case, the eight-wheeled machine will ride over these depressions with no appreciable jar. The wheels are arranged in two double trucks, and upon them the body of the vehicle is mounted. The steering gear controls three pairs of wheels, namely, the rearmost pair and the two forward wheels, which are the drivers, be turned oppositely to those of the forward truck, because they lie on the opposite side of the fulcrum. The riding qualities of this car are claimed to be excellent. By reducing the shaking and racking of the four-wheeled type of machine, not only is there a saving of the tires, but of the machinery as well. Should one of the wheels be broken, the car could ride with perfect safety on seven wheels. The idea of using a double set of tires on a machine in order to distribute the load is not exactly new. Motor trucks are commonly provided with twin tires. However, by arranging these tires on separate wheels, one is assured of distributing the weight equally, which is not always the case with the twin tire construction.

...otographed by Dr. Kassner.

Snow Garlands

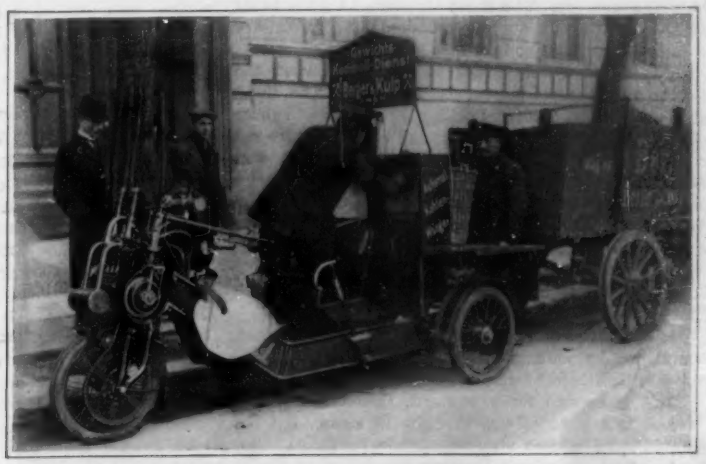
DR. CARL KASSNER, of the Royal Prussian Meteorological Institute, has given the name "Snow Garlands" to a curious form occasionally assumed by snow lying on window-ledges, the branches of trees, etc., when the temperature is about at the freezing point. As the strip of snow softens it slips down in the middle, like a sagging rope, but continues to be supported at the ends. The snow garland shown in the accompanying picture was photographed by Dr. Kassner. It formed on the building occupied by the Meteorological Institute in Berlin, and was probably the first one ever photographed, as well as the largest ever recorded. The distance between the points of ... was about 3 feet 9 inches; the vertical sag ... to nearly 16 inches; and the average thickness of the rope of snow was about 4 inches. Probably the snow was first softened by the heat of the building. The middle, after slipping down, was removed from this source of heat and froze again; otherwise it could hardly have maintained its integrity for any length of time. The whole process depends upon gradual changes and alterations of temperature, and the phenomenon is probably of rare occurrence.

Coal Dealer's Portable Weighing Scale

IT is common for the public to hold the coal merchant with the ice dealer, and the gas company, as one who should be universally distrusted. Realizing this, an ingenious coal dealer living in Berlin has hit upon a scheme for gaining the confidence of his customers. He has fitted up a three-wheeled motorcycle with a weighing scale on which the baskets of coal, as they are unloaded from the wagon are weighed before being dumped into the coal chute. The consumer is at liberty to examine the weighing and satisfy himself that he is receiving full measure. Of course, the scales must be accurate to meet the requirements of the government. As a consequence of this procedure, the enterprising coal dealer has witnessed an immense increase of business, and his relations with his customers are somewhat more pleasant than of old.

Transfers of Territory in Africa

THE important changes made in the map of Africa by the Franco-German treaty, signed November 4th, are shown by charts in the December numbers of the *Geographical Journal* and the *Scottish Geographical Magazine*. In return for her recognition of a French protectorate over Morocco, Germany receives a great slice of territory adjoining her colony of Kamerun to the south and east, and amounting (according to one estimate) to 107,270 square miles, i. e., an area almost as great as that of New England plus New York State. The black population incidentally handed over to Germany is estimated at from 1,000,000 to 1,200,000. On the other hand, relatively small tracts are ceded from Germany to France in the northern corner of Kamerun and on the frontier between Togo and Dahomey.



Weighing the coal in the presence of the consumer.

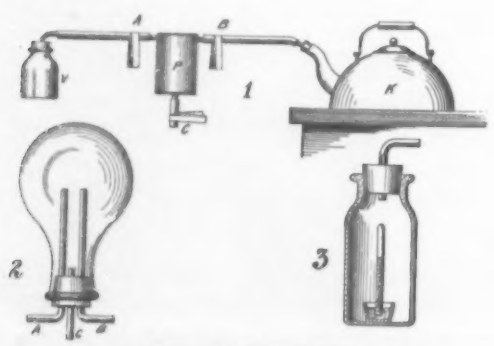
The Laboratory

Some Suggestions for Home Experiment

An Easily Made Vacuum Apparatus

By Russell Edson.

AN amateur who possesses the means of making a good vacuum has within his reach a great number of very interesting experiments. There are three principal methods of producing a vacuum: The first employs the suction pump, with piston and plunger; the second, the mercury or water pump; the third, condensation of steam. The first two methods are usually beyond the reach of the amateur, as they are expensive or difficult to make. The condensation of steam method is, however, very easy and simple, but as usually carried out is very limited in its application. The usual way is to boil some water in a flask or other vessel and after steam has been coming off for a minute or so to take away the fire and close the mouth of the vessel tightly. By cooling the vessel a very good vacuum can be produced in it. Such a vacuum is of very little use, however, as the water in the bottom of the vessel and the heat used in exhausting the air render it worthless for most experiments. A modification of this method, illustrated herewith, avoids these difficulties and allows a very good vacuum to be obtained in any vessel without direct contact with either heat or water.



Steam vacuum producer.

See Fig. 1. *K* is a kettle on a stove with the water boiling at a brisk rate. It must be provided with a rather tight fitting lid or a gasket which can be pressed down so as to force most of the steam to issue from the spout when desired. The spout is provided with a cork in which is fitted a short piece of glass tubing. *P* is the vacuum pot, the most important part of the apparatus. It is either a can made for the purpose of rather heavy galvanized iron, or a small coffee pot or other cooking utensil which can be soldered air-tight. When the vacuum is formed this pot has to stand a pressure of nearly 15 pounds to the square inch on the outside and must have sufficient strength to resist this pressure and withstand collapse. Three openings are made in this pot, and a short length of brass tube is soldered into each hole, projecting out about an inch and a half. Two of the openings should be near the top and the third near the bottom. A Florence flask, such as used in chemical work, was found to stand the pressure well and made a good vacuum pot. It is easier to arrange than a metal pot, but must be used with more care to prevent cracking from sudden changes in temperature. Fig. 2 shows the method of setting up this flask. A three-hole rubber stopper is used with glass tubing which fits tightly in the holes and is well greased to prevent leakage. Two of the tubes are long and bent as shown. The other is short and straight. The flask, stopper and glass tubes can be obtained at any drug store. The tubes are easily bent by heating in a gas jet.

Whether the metal pot or the flask are used the balance of the arrangement is the same. The three tubes *A*, *B* and *C* are fitted with short pieces of rubber tubing, each provided with a spring clothes pin to act as a valve. The tube *B* is connected with the tube in the spout of the kettle; the tube *C* is simply an outlet for water and steam, and the tube *A* is connected by glass or rubber tubing with the vessel *V* to be exhausted. The apparatus is worked as follows:

(1) *A* is closed. *B* is opened, then *C*, and by closing tightly the lid of the kettle, steam is forced through *P* and out of *C*.

(2) When the steam is coming freely *C* is closed, then *B*, and by pouring cold water on *P* the steam contained within is condensed.

(3) *A* is opened for a moment, then closed.

(4) *B* is opened slowly to draw in steam, but not so rapidly as to suck air through the kettle. Then *C* is opened, steam forced through for a few moments, then *C* is closed. Next, *B* is closed, cold water poured on *P*, and the operation repeated. Each time a good part of the air in *V* is exhausted. After a number of these cycles, which are quickly performed, a very good vacuum will be produced in *V*.

To ascertain how good the vacuum is a barometer should be constructed. This is easily done by closing one end of a three-inch glass tube (in a flame), filling it with mercury and inverting it over a shallow cup of mercury. The whole is then placed in a small bottle with a one-hole rubber stopper, and, before the operations commence, placed in connection with *V*. After a number of cycles the mercury in the tube will begin to sink. The perfection of the vacuum will be shown by the height of the mercury above the level of the mercury-cup. In the air the height would be about thirty inches. The degree of vacuum that can be obtained depends upon the tightness of the apparatus and also upon the vapor tension of water. This latter in turn depends upon the temperature to which the flask is cooled before *A* is opened on the last few cycles performed. If the temperature is 60 degrees the best possible vacuum will show 0.5 inches of mercury. With temperature at 50, 0.35 inches; at 40 degrees, 0.25 inches; at freezing, 0.18 inches.

The vessel *V* can be any wide-mouthed container closed by a rubber stopper penetrated by a tube. Of course the strength of the bottle must be considered. When the bottle is exhausted it may be disconnected from the apparatus by removing the rubber tube *A* from the vacuum pot.

Of the many interesting experiments possible with this apparatus a few are indicated below:

(1) Place a fly in the bottle and exhaust part of the air. He will vibrate his wings, but will be unable to fly. (2) An electric bell placed inside the vacuum can be heard only when there is air present, becoming almost inaudible when the air is withdrawn. Do not allow the bell to touch the bottom or sides of the bottle. Suspend it by a string, and pass fine bare wires through the rubber stopper for carrying the current. (3) A feather in a vacuum rattles around, when shaken, like a piece of wood. (4) Observe the action and growth of a plant when it is placed for several days in a partial vacuum. (5) A rubber bag or toy balloon, rather loosely blown up, when placed in a vacuum will expand rapidly to the bursting point.

An Improved Laboratory Label

By William P. Munger

WHEN a number of samples of the same kind are undergoing analysis at the same time mistakes frequently occur, because the chemist is interrupted by other work and cannot remember the exact contents of each dish. If paper labels are used, they are constantly dropping off when the glassware is heated, and if labels are ground on the glassware, confusion results by forgetting to erase the symbols when transferring the liquid from one vessel to another.

To obviate these difficulties, the writer has devised the detachable label shown in the figure. It consists of a small flat piece of glass with a hook drawn at one end, and having the flat side opposite the hook

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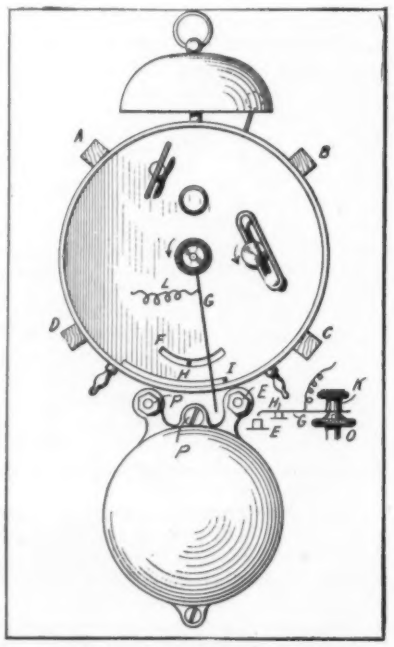
fourths inch down, lay the hot end on a piece of asbestos board and flatten the end with another piece of asbestos board nailed to a block of wood. While yet holding the flattened end, with the asbestos, pull on the free end, and bend back so as to form the hook. When moderately cool, cut it off with a small flame or the blast flame. When entirely cool, grind the face for writing, by putting emery powder and lard oil on a glass plate and rubbing the label thereon till the desired surface is attained.

An Audible Timer

By C. S. Bourne

IT is often desirable to mark short intervals of time for various purposes such, for instance, as the boiling of eggs or other operations in cooking, or it may be to time a debater in his talk when so agreed.



Device for marking short time intervals.

To confine the eyes to a watch is to lose the use of them for other purposes for the time being. To set an alarm-clock index hand would involve more trouble and would be inaccurate for very short intervals. Having a love for useful novelties, the writer devised a simple apparatus to perform this service. Perhaps some SCIENTIFIC AMERICAN readers may like to duplicate it.

'G shown, in the drawing, it consists of an ordinary .ckeled alarm clock turned face side down on a base oard. The blocks *A*, *B*, *C*, *D* are glued to the base to keep the clock in place, but permit the clock to be lifted out when used for other purposes. Below the clock there is an electric "buzzer" of the type used for door-bell purposes and costing from 30 to 40 cents. This is screwed to a block to bring it to the proper height, and the block is glued [illegible] To the end

SIXTY-SEVENTH ANNUAL REPORT

NEW YORK LIFE

INSURANCE COMPANY

346 Broadway, New York

Balance Sheet, January 1, 1912

ASSETS		LIABILITIES	
Real Estate	$ 10,616,711.90	Policy Reserve	$566,919,308.00
Loans on Mortgages	116,298,323.50	Other Policy Liabilities	7,359,006.83
Loans on Policies	113,516,068.47	Premiums and Interest prepaid	3,385,535.50
Bonds (market value Dec. 31, 1911)	421,122,821.04	Commissions, Salaries, Taxes, etc.	1,287,423.53
Cash	7,284,253.12	Dividends payable in 1912	11,690,143.32
Premiums in course of collection	7,724,930.65	Reserve for Deferred Dividends	83,064,153.00
Interest and rents due and accrued	8,121,577.82	Reserves for other purposes	10,979,116.32
Total	$684,684,686.50	Total	$684,684,686.50

TO THE POLICY-HOLDERS:

Within the year just closed the Insurance Department of New York has examined the Company. The examination went much deeper than the mere question of solvency and a correct statement of assets and liabilities. It went to questions of economy, efficiency and especially to the attitude of the Executive Officers toward the rights of policy-holders, the laws of the State and the regulations of the Department.

It would not be possible for me by any use of statistical tables, ratios or comparisons, to present a statement so luminous and convincing as that made by Honorable William H. Hotchkiss, Superintendent of Insurance, at the close of his examination.

It is the last word in State supervision—impartial but just—constructed on the sound theory that it is as much the duty of a public official to commend fine public service as it is to denounce wrong-doing or inefficiency. The muckraker will find nothing interesting in it. You will. It is, therefore, printed below in full.

Darwin P. Kingsley

President.

New York, January 10, 1912

(Copy of Memorandum filed at Albany, December 9, 1911, by Hon. Wm. H. Hotchkiss, Superintendent of Insurance.)

State of New York—Insurance Department

IN THE MATTER OF THE EXAMINATION OF THE NEW YORK LIFE INSURANCE COMPANY

MEMORANDUM OF THE SUPERINTENDENT

It is thought proper to file with the report on the examination of the New York Life Insurance Company, dated November 21, 1911, the following memorandum:

The examination of this Company now completed is the second since the enactment of the amendatory laws of 1906. It is even more complete and painstaking than was the examination of three years ago.

The New York Life is one of the great life insurance companies under the supervision of this department. As of December 31, 1910, such Company had assets approximating closely to $650,000,000, outstanding insurance exceeding $2,000,000,000, and an annual premium income of about $80,000,000. It disbursed to policy-holders in 1910 over $53,000,000. As of December 31 last, such Company held in reserve for its policy-holders—including deferred dividends—upwards of $600,000,000, and in contingency and special funds for the protection of policy-holders, nearly $18,000,000. **It does business generally in the United States and in 39 principal nations of the world.** It has approximately 996,000 policy-holders.

The mere recital of these figures indicates the magnitude of the task committed to the examiners, and gives emphasis to the fact that after an examination covering seven months, such examiners concluded:

> ***"The final results of this examination show that the work of the Company is done efficiently and economically; its claims are paid promptly; its policy-holders are treated fairly; its dividends are apportioned and paid without discrimination; and the Company complies with the requirements of the law and the rulings of the supervising authorities in both the spirit and the letter."***

The above statement should not be taken, however, as indicating that this Company and its work were in no respect found the subject of criticism. The fact worthy of note is that the criticisms made by the examiners have to do with minor details, and do not concern the management, the observance by such management of the law, the Company's treatment of policy-holders, or matters of Company policy generally. **Indeed, the criticisms set forth in the report are so relatively unimportant as to be in effect negligible.**

The impression made by the examiners' report was considerably strengthened by a personal inspection of the Home Office of this Company made by me shortly after such report was completed. Evidences of economy, both in the number of employees and in the space occupied, as well as in the use of labor-saving devices of various kinds, were noticed. The efficient organism of this great institution, centering as it does in its so-called "office committee," was everywhere evident. **An almost overscrupulous desire to comply with every statutory requirement or departmental regulation was also noted.** Indeed, for general Home Office efficiency, for watchfulness over the little things that go to increase a company's expense ratio, for accuracy of record and in accounting methods, and for a full observance of the law, **this Company is entitled, not merely to the commendation given it by the examiners, but to the official approval of this department here recorded.**

William H. Hotchkiss

Superintendent of Insurance.

Dated, Albany, December 9th, 1911.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AUTOMOBILES

A NEW WHITE STEAMER. Model O-O, complete with top. Will sell at a very reasonable price. Address A. A. Hopkins, 963 St. Nicholas Ave., New York City.

BUSINESS OPPORTUNITIES

FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from $1.00 to $100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metallic Mfg. Co., 438 N. Clark, Chicago.

WILL BUY a patented article suitable for advertising or mail order business. One using electricity preferred. Address, with full particulars, Ames & Co., 120 Boylston Street, Boston, Mass.

I UNDERTAKE the placing and give all information concerning the purchase and the sale of oil fields, oil products, mining, etc. in Caucasus. I seek also representation of good firms for Baku and Caucasus. Address G. Kainin, Emge-Caucasian Naphtha Company, Baku, Bolt Gorod, Russia.

OLD COINS

OLD COINS BOUGHT AND SOLD.—My new 50-page coin selling catalogue, just out, free. Buying coin catalogues sent on receipt of 10 cents in stamps. William Hesslein, Malley Building, New Haven, Conn.

PATENTS FOR SALE

FOR SALE. Patent Saw-set, No. 988,579. For further particulars and full information regarding terms, etc., address Mrs. Wm. J. Boynton, 3708 South Alaska St., Tacoma, Wash.

REAL ESTATE

TEXAS INVESTMENTS.—Buy farm orchard garden lands near Houston, the greatest and most prosperous city in the southwest, where values are going up all the time and fortunes made in real estate in short while. Easy terms if desired. Single crop pays for land several crops annually. Address B. C. Robertson, 501 Kiam Bldg., Houston, Tex.

WANTED

WANTED—A man or woman to act as our information reporter. All or spare time. No experience necessary. $50 to $100 per month. Nothing to sell. Send stamp for particulars. Sales Association, 695 Association Bldg., Indianapolis, Indiana.

WANTED.—A second-hand refracting telescope, equatorially mounted, with clock drive, 8 or 10 inch objective. Must be in first class condition. Address Telescope, Box 773 New York.

MISCELLANEOUS

MATHEMATICAL INSTRUMENT MAKER, aged 39, experienced in physical, optical, surveying, electrical, and experimental work, seeks position. C. Feldmann, 653 Bloomfield St., Hoboken, N. J.

PURE VERMONT MAPLE SUGAR. From producer to consumer. Orders taken now for delivery in March and April. Limited Supply. For further particulars and terms address Vermont Farm Products Company, Chester, Vermont.

PLUMBERS FORCE CUPS. 4 inch, $3.50 per dozen, 6 inch, $5.00 per dozen. Freight paid. For further information address A. W. Thoma, Manufacturers' Agts., Mineral Point, Wis.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated. MUNN & CO., Inc.

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully protected.

Inquiry No. 9256.—Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257.—Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to skin corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261.—Wanted, a manufacturer to make card games.

Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

METHOD FOR PUTTING TOGETHER OF THE METAL WIRES IN SHAPES FOR LADIES' HATS.—J. C. BARTE, Hostrupsvej 10, Copenhagen, Denmark. The characteristic feature of this invention consists in placing the wires together crossing one another, upon a firm metal foundation. Through the subsequent heating caused by the welding, the wire lying on top sinks on both sides of the underneath one, on account of the softening of the metal produced by the heating. By this means all the wires on all sides around the places where they are brought together will lie in the same plane.

NURSING WAIST.—J. JACOBY, 143 Prince Street, New York, N. Y. The object in this case is to provide a nursing waist arranged to permit the use of an embroidered or open mesh front, to allow convenient opening at either side of the front for nursing purposes, and to thoroughly protect the body of the wearer and avoid undue exposure while nursing.

COLLAR SUPPORT.—N. A. KRISCHER, 121 Prince Street, New York, N. Y. This invention provides a supporter that may be adjusted as to length with facility and dispatch; provides a wide range of adjustment as to the length; provides means for guiding the longitudinally sliding members of which the device is composed, and provides an arrangement of orifices for so receiving sewing thread as to permit of a secure and ready sewing of the device to the collar.

Electrical Devices.

WAVE DETECTOR.—THOMPSON H. LYON, 32 Morris Road, The Preygen, Southampton, England. This invention relates particularly to wave detectors of the kind known as rectifiers, which employ crystalline or crystalloid substances to be energized by electric oscillations in connection with wireless telegraph and telephone apparatus. Many of these wave detectors may be used without a battery or other source of local current. It has been found that the rectifier type of wave detector is apt to lose much of its sensitiveness after being in use for some time, particularly if strong electric currents are passed through it, and if it is employed in close proximity to a powerful radiating circuit. Such a detector needs frequent adjustment, and is often a problem to adjust properly. Mr. Lyon made the discovery that the lead ore known as cerusite ($PbCO^3$) has natural properties that fit it for use as a detector, and that it does not deteriorate in use and is affected very little by local disturbances. It needs only occasional attention, and may be adjusted very easily and quickly whenever necessary.

Of Interest to Farmers.

POULTRY FEEDER.—W. H. WATSON, Riverdale, Neb. In this feeder each time the platform is depressed a measured quantity of food is distributed, and the action of the device is positive. The feed screw always feeds and the operation is not dependent upon gravity for dropping food onto the distributer. Fowls are always able to obtain food when hungry, but they must hunt for it when distributed, thus getting exercise for the digestion.

STUMP EXTERMINATOR.—D. C. ANDERSON, La Prairie, Minn. This invention is an improvement in means for exterminating stumps, and the purpose is to provide a novel construction whereby the inside and the outside of the stump may be acted on at the same time in order to get away the stump, and thereby destroy the same by reducing it to shavings.

LIFTING MECHANISM FOR GANG PLOWS.—T. J. CHANDONNET, Waubon, Minn. In this invention by placing the lifting mechanism upon the plow itself, the latter is permitted to rise and fall to conform to the unevenness of surface of the field, at the same time being independent of other plows in the gang of plows, which would not be the result if the lifting apparatus were mounted on the frame of the gang of plows.

Of General Interest.

PHOTOGRAPHIC PLATE.—W. S. BENSON and J. BRIELOFF, 168½ Delancey Street, New York, N. Y. The invention provides a camera plate with means for affording sufficient space between the separate plates when arranged in a pack, to give the required clearance so that one plate can be separated from the others. The plate is extremely thin, but affords the clearance without any excessive metal and without the necessity of any complicated mechanism for forming the same.

FINGER RING.—A. GRABHORN, 30 West 31st Street, New York, N. Y. This invention refers to finger rings, and the object is the provision of a finger ring having a spring band and a crown permanently secured to the band at one end of the latter, and having means for removably securing the free end of the band to the crown.

SIGHTS FOR SMALL ARMS AND ORDNANCE.—J. T. PEDDIE, Caxton House, Westminster, London, England. The object here is to enable a sight to be initially corrected, so far as elevation is concerned, by a fine adjustment with the cross bar at any one range and to render this adjustment or correction sufficient for all ranges within the limits of the sight. For example, if it is necessary to correct the sight by a fine adjustment of 5 degrees at a range of 500 yards. This when effected will be simultaneously made for 900 yards or any other range on the sight.

HYDRAULIC SYSTEM OF ORE SEPARATION.—W. POLGLASE and F. BATES, care of BERRY & BENNETT, Room 17, Phelps Block, Great Falls, Mont. This invention relates to a system for the separation of high and low grade ores, such as copper and gold, and including the shines. Another object is to provide a system in which a plurality of separations are obtained by a rising current in stand separators, and in which intermediate separations are obtained by baffle launder separators.

ANT TRAP.—A. R. R. SEIFERT, deceased, assignee, J. GACKENHEIMER, P. O. Box 296, Brenham, Texas. This invention is an improvement in ant traps, and has for an object to provide a novel construction including a body portion having upper and lower inlet chambers, and a trap connected with the upper inlet chamber by a passageway through which the ants may conveniently pass.

CAMPING ACCESSORY.—S. E. CREASEY, Alfred, Maine. The principal object which the present invention has in view is to provide a stool capable of arrangement for conversion into the following: First, a stool the height whereof may be varied; second, a table; third, in conjunction with other stools of similar construction, a bed; and fourth, a packing crate or holdall.

WELL CASING SPEAR.—C. A. RASMUSSEN, Coalinga, Cal. The improvement is in spears such as are used for removing casings from wells, and aims to effect the release of the spear from the casing should the latter refuse to yield under the pulling by simply jarring the tool. To this end the gripping jaws are slidable on the tapered body of the stock, and are normally forced toward the small portion of the body, with means to lock the jaws in their lower operative positions, releasable by pressing the jaws inwardly.

ANCHOR.—H. N. JACKSON, care of Wm. G. Nicoll, Babylon, N. Y. This invention pertains to an improved form of anchor, and the purpose is to provide such a construction that when not in use it will lie flat upon the deck or along the side of a vessel and not take up any unnecessary room, and, further, will accomplish all the purposes of the present form of anchor, and can be instantaneously folded.

SURGICAL IMPLEMENT.—J. A. FULTON, Astoria, Ore. Among the principal objects of the present invention are to provide an instrument for local application of heat for the therapeutic treatment of disease; to provide an application for controlling the applied heat, and for regulating the same, and to provide means externally visible, whereby the heat internally applied is accurately disclosed.

APPLIANCE FOR SUBJECTING PORTIONS OF THE HUMAN SYSTEM TO HEAT OR COLD.—J. A. FULTON, Astoria, Ore. The object of this improvement is to make it possible to either absolutely destroy pathogenic bacteria as may be reached by an application of heat or cold at a temperature that will be destructive to them, or at least retard their development, the treatment being at a temperature which will not be destructive to the vitality of the tissues.

BERRY CRATE ATTACHMENT.—P. A. WIMBROW, Whaleysville, Md. Usually the lids or covers and also the trays or partitions of fruit crates are provided with transverse wooden ribs or slabs for holding the berry boxes in place, or preventing their vertical movement during shipment. This invention is a cheap, easily applied and effective substitute for such retainers which will hold the berry boxes securely in place without the possibility of injury to their contents.

METHOD OF DESICCATING MILK.—H. I. ANDREWS, R. D. No. 40, Darien, Conn. The method in this case consists essentially in subjecting the milk to a continuous gravity flow, mixing the milk during the flow with ozone and subsequently evaporating the moisture in the milk by subjecting the milk during the gravity flow alternately to heat and cold.

Hardware and Tools.

ANTISEPTIC RUBBER DAM HOLDER.—C. A. HALLETT, Box 28, Riverhead, N. Y. This invention relates to a container adapted to carry rubber dams used in the dental profession to keep saliva from cavities in the teeth while the same are being filled. An object of the improvement is to provide a neat, compact holder from which the dams may be drawn as needed, which holder may be readily closed and which possesses means for carrying an antiseptic solution.

POCKET KNIFE.—W. M. IRICK, Nixa, Mo. The object here is to provide a knife having a whet stone or other sharpening material provided in one side of the holder thereof, this handle portion being removably secured to the bolsters of the knife, together with convenient means permitting the removal of the handle portion when it is desired to use the stone or sharpening material.

TRAP FOR CATCHING AND DESTROYING INSECTS.—GEORGES MAIRE, 108 Rue du Prince Abdel-Moncim, Alexandria, Egypt. The aim of this inventor is to provide an apparatus for catching and destroying certain in-

sects which are harmful to agriculture and butterflies in particular. It is characterized by a cage provided with inlets presenting the form of cavities enabling the insect to enter the trap but preventing it from leaving.

WEATHER STRIP.—A. SOLOMON, 695 Jackson Ave., Bronx, New York, N. Y. The purpose in this case is to provide a weather stripping and runway for windows, which will be watertight, easy of operation and simple of construction. This is obtained by positioning on the parting strip of a window an N-shaped metallic member within each of the openings of which is adapted to slide an L-shaped strip attached to the opposite sashes.

STROPPING MACHINE.—J. W. HAWKINS, 121 Union Avenue, Passaic, N. J. This invention provides a machine more especially designed for stropping safety razor blades in a very simple and effective manner, the cutting edge of the blade being held in contact with a revoluble stropping roller and moved bodily in the axial direction of the roller to insure the formation of a keen cutting edge.

PROTECTIVE CASTER.—F. L. S. MEANS, 56 Sturbridge Street, Mattapan P. O., Boston, Mass. This invention pertains to casters, and is particularly adapted for use on trucks used in factories. An object is to overcome the objection of loose threads by providing a caster which will not pick them up on the floor, and at the same time will possess all of the advantages adherent to a new caster.

SAFETY RAZOR AND CORN KNIFE.—F. PERES, care of J. A. Arroyo, 42 Broadway New York, N. Y. This inventor provides a device which possesses all of the advantages of the safety razors now in common use, and which additionally affords a means whereby the razor may be readily cleaned. Means also provide a razor that prevents the accumulation of lather on the working face of the razor while shaving.

WRENCH.—W. W. WHITE, care of W. B. Maxwell, Elkins, W. Va. An object here is to provide a wrench in which the jaws may be quickly closed by a single movement and will remain closed, due to the engagement of a spring-pressed pawl with a series of rack teeth on the main bar. Further, to locate the pawl-releasing means of the side opposite the jaws in convenient reach of the operator.

LOCKING DEVICE.—A. MOEBES, JR. (address 502 Mission Street, San Francisco, Cal.), and H. T. MOORE, San Francisco, Cal. This invention refers more particularly to a device adapted to be removably mounted on a box or other receptacle, and consists of automatically operating means for locking the cover of the box in a closed position, and further means manually operable for releasing the cover and allowing it to assume an open position with respect to the receptacle.

FLAT IRON WITH DETACHABLE HANDLE.—L. TRESTMAN, 1552 Hoe Avenue, Bronx, New York, N. Y. An object here is to provide a detachable handle with means for positively locking it to the body portion of the iron, in such a manner that there is no necessity for undependable springs, which are liable to weaken, and get out of order, so that occasionally the weighty body portion of flat-iron drops from the handle.

Machines and Mechanical Devices.

LATHE ATTACHMENT.—W. D. JOHNSTON and M. J. O'LEARY, 501 Minn. Avenue, Chickasha, Okla. This invention is an improvement in lathe attachments, and with its use the capacity of any lathe is doubled, since the work may be finished inside and outside at the same time. The work is held in the usual clutch of the lathe, and the usual tool operates on the outer surface thereof, while the tool of the attachment finishes the inside.

KINETOSCOPE SHUTTER.—W. H. C. DUDLEY, JR., Box P. Americus, Ga. This invention consists in constructing a rotary disk to travel in front of the projecting lens of a moving picture machine, having formed in the path of the light one or more elongated curved openings, the openings being divided lengthwise from the median section of each opening by means of tongue-like members, said members being gradually increased in width toward the obscuration section of the disk.

ALARM CLOCK AND WATCH.—C. L. FAIVRE, care of J. N. Galloway, Iowa City, Iowa. This invention has reference to an alarm mechanism for application to clocks or watches and consists in certain devices for locking and releasing the usual vibratory hammer and also manually operable means for effecting the release of the hammer, to operate the alarm, at a predicted time.

AGITATOR.—P. G. HOLLSTEIN, Hoboken, N. J., assignor to J. M. LEHMANN CO., 13 Laight Street, New York, N. Y. This machine is for agitating chocolate molds and expelling air bubbles from blocks of chocolate; and it operates with any amount of vibration within certain limits, with less noise and of larger capacity than the agitator now in use; also it will operate while the support of the mold carrier is stationary as regards linear movement, or while operating as a conveyer to carry molds from one end of the machine to the other.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes for Inventors

Facing Apples in a Barrel.—You have doubtless often noticed the top layer of apples in a barrel, how they are all placed with the stems up presenting an attractive appearance. But you have not thought how it was done. Ordinarily the operator must reach down into the barrel to place the apples in circles upon the head at the bottom and when the facing layer is complete, apples are poured in until the barrel is filled. Benjamin Holt of Albion, N. Y., in a patent, No. 1,009,905, provides a yielding and adjustable table supported by a suitable device a proper distance below the open end of the barrel and the apples are conveniently faced upon this table so that the person facing up the apples can see just how they will look when the barrel is open. A head is now applied over the facing layer and the barrel turned upside down. The facing device including the table is removed and apples poured in to fill the barrel and the other head applied, completing the barreling operation.

Improved Engine Cylinder.—In patent, No. 1,009,837, the patentee, R. L. Gruber of Milwaukee, Wis., seeks to combine in a single gasoline engine the water-cooling and air-cooling principles embodying the advantages of both without the disadvantages of either. In doing this he provides a water jacket, which envelops only one longitudinal half of the cylinder, the other half being provided with external air-cooling ribs or the like for cooling by an air current. There being no inclosed space with parallel walls, the freezing water in the jacket cannot burst its walls, and on the other hand, should the water dry up, there is still sufficient cooling surface exposed to the air to keep the cylinder at a reasonable temperature.

Another Parsons Turbine.—Charles Algernon Parsons of Newcastle-upon-Tyne, England, has patented No. 1,009.784, a marine turbine installation in which several turbine elements have impulse and reaction sections arranged in series to allow the working fluid to pass alternately through impulse and reaction sections.

Pebbly Surfaced Wall Paper.—A wall paper presenting a pebbly surface is presented in patent No. 1,009,790, to James A. Ross of Boston, who incorporates coarse sawdust granules in the paper stock so the surface of the paper will present an irregular, rough or pebbly surface.

Making, Trimming and Coloring Plumes.—Eugene W. Moch of New York has procured five patents, Nos. 1,009,918, 919, 920, 921 and 922, relating to the production or to the treatment of plumes. One of the patents is for a multiplex plume, another for a device for assembling fillers for compound plumes, two for plume trimming devices and the last for an apparatus for coloring plume stems.

Sausages without Casings.—By suitable treatment, James Lee Boyle of Ocean City, N. J., provides a sausage with an external film or coating formed of the same material as the body of the sausage, but of greater tensile strength. He does this by molding the meat into the desired shape and searing the surface while in the mold to create a coating. The patent is No. 1,009,953, and one-half is assigned to James Kneisler of Philadelphia, Pa.

An Illuminated Flat Iron.—A smoothing-iron with a hollow transparent body and containing incandescent light bulbs which operate to heat it, is described in patent, No. 1,010,092, to Theodore G. Thomas of Houston, Texas. The bulbs also serve to illuminate the work which is being ironed.

Mr. Berliner and Lapsed Patents.—A Correction.—Mr. Berliner desires us to call attention to an error in our statements regarding his talking machine patents, in our issue of January 13th, 1912. It was not Mr. Berliner's Canadian patent which was permitted to lapse on account of non-payment of taxes, but the Suess patent which was owned by Mr. Berliner and which covered a modification of the broad claim of Mr. Berliner's patent.

Responses to Official Communications.—It is frequently found that responses to official communications are both interesting and amusing. Recently the Patent Office

issued a circular asking for the correct address and any change in name of attorneys for use in revising the roster of registered attorneys. The change in name was desired as the names of firms frequently change and it is also a fact that some registered patent attorneys are of the gentle sex and even patent attorneys get married sometimes. Replying to this official circular a registered patent attorney addressed the chief clerk as follows:

November 14th, 1911.

Sir: I respectfully return your communication and state that I have not gone as yet to visit St. Peter, but am fighting the world, the flesh, and the individual said to wear horns, to the best of my ability, with my office at ——————

I was not married when I registered as a patent attorney, but have since, and the lady kindly took my name, and therefore there has been no occasion for change of name, and as I will be 73 years of age at my next birthday and my wife is ten years younger than myself, the chances are that she will not give me an opportunity to marry again, but if so, bearing your letter in mind, I will certainly retain my present cognomen, and if I should change my address I will not fail to inform your office.

A Swimming Appliance Competition Proposed.—Swimming is attracting more and more attention as a competitive sport. Many swimming appliances or aids to swimmers have been devised and numerous patents have been granted for the subject. An interesting number on a swimming tournament program would be a race open to all comers supplied with swimming appliances. This would test in a measure the relative merits of the appliances, would commend itself to promoters of such appliances as an opportunity to exploit their devices and is urged on managers of swimming exhibitions as something that should be a drawing card as a decided and interesting novelty. At the same time, the announcement of such a contest would stimulate inventors to the production of some important devices along this particular line.

A Novel Non-refillable Bottle.—A bottle designed to prevent refilling is presented by William White Clark of Covington, Ga., in patent No. 1,011,580 and has a disk valve in the form of a false bottom slidable piston-like in the body of the bottle and having a transverse locking rod which operates as a pawl permitting the valve to slide toward the neck of the bottle in decanting its contents but preventing any retrograde movement of the valve such as would be necessary to secure a refilling of the bottle.

An Electrically Heated Glove.—Electric foot warmers have been provided, and now Arthur L. Carron of Binghamton, N. Y., has patented No. 1,011,574 a glove or mitten in which is incorporated an electric conductor provided with terminal contacts which are exposed at predetermined points in the glove surface.

Cooking with a Steam Radiator.—Harriet L. Galbraith of Washington, D. C., in a patent No. 1,011,608 mounts a cooking vessel upon a steam radiator and heats it by the steam discharged from the outlet passage of the radiator, the cooker being specially constructed to facilitate its use in the manner suggested.

Nestable Parachutes in Series.—In a patent, No. 1,011,683, Jean Francis Webb of New York city provides a flying machine with a number of parachutes arranged in series and normally inactive and nested one within the other except when the machine falls. At such time, means are operated to unnest the parachutes and bring them into operation to sustain the machine as it falls.

A Wooden Barrel with Metallic Shell.—John McGregor of New York city has patented No. 1,009,326, a barrel with end-tongued, wooden staves and wooden heads grooved for the end-tongues of the staves, together with a metal positioning-shell for the staves and metal heads which hold the wooden heads in position, the metal heads being screw-threaded in the ends of the shell.

An Automobile Fire Engine.—Leon B. Lent of Brewster, N. Y., presents in patent No. 1,010,158 an automobile fire engine in which a motor is mounted on the frame and a main shaft is driven by the motor, transmission mechanism being arranged between the motor and the supporting wheels of the machine. A rotary pump for fire extinguishing purposes has its impeller permanently mounted on the shaft so it will constitute a fly wheel for the motor, and the shaft operating both as a pump shaft and as a vehicle propeller shaft.

Legal Notes

Recognizes Esperanto.—In *ex parte* Sanitary Knitting Co., the Patent Office in holding the word "Saniga," which is the Esperanto word for sanitary, unregistrable as a trade-mark for underwear and hosiery, since the word "sanitary" is descriptive of such goods, the Commissioner of Patents says after referring to the matter relating to Esperanto in an encyclopedia, "It is believed under such circumstances this Office is justified in recognizing Esperanto as a language in a case of this kind."

Patent Assignments and Assignments of Trade-marks.—The assignment of a patent requires only the signature of the assignor. For obvious reasons, it is advisable to have the assignment acknowledged before a notary or other officer, but such acknowledgment is not necessary to the validity of the transfer. With trade-marks, it is different; the assignment of any registered mark and of any mark for the registration of which application has been made, must not only be by an instrument in writing, but must be acknowledged according to the laws of the country or State in which the same is executed. This results from the positive requirement of the trade-mark Statute (Sec. 10 of the Act of February 20th, 1905) which, referring to the assignment of trade-marks, explicitly says it "must be by an instrument in writing and duly acknowledged according to the laws of the country or State in which the same is executed." The statute does not require the assignment of a patent to be acknowledged, but it does (Act of March 3rd, 1897) provide that, when acknowledged, the proper certificate under seal of such acknowledgment shall be *prima facie* evidence of the execution of the assignment.

The Automobile Chain Tire Grip Case.—Petition has been filed to the Supreme Court of the United States for writ of certiorari directed to the United States Circuit Court of Appeals for the Seventh Circuit, in the case of Excelsior Supply and Motor Appliances Company, petitioner, v. Weed Chain Tire Grip Company, Harry D. Weed and Parsons Non-Skid Company, Limited, respondents. The patent in question is No. 723,299, granted to Harry Parsons, of London, England, on March 24th, 1903, for "An Armor for Pneumatic Tires." The petition for certiorari shows that on January 2nd, 1911, the Court of Appeals for the Seventh Circuit rendered an opinion holding that the patent in suit was invalid and reversing the decision of the lower court; that on April 11th, 1911, the said Court of Appeals granted a rehearing and after reargument the Court on July 27th, 1911, held that the patent was valid and affirmed the decision of the lower court. It appears that the patent in suit forms or has formed the basis for probably twenty-four or more suits pending in five or more different judicial circuits of the United States. The case is said to be one of importance to every automobile owner or to everyone who may own an automobile during the remaining nine years of the term of the patent. The subject of the patent is the well-known tire chain described in one of the patent claims as "comprising attaching elements at opposite sides of the wheel, and an anti-slipping or protective medium secured to the attaching elements and extending across and around the periphery of the wheel, said parts being disconnected from though retained on the wheel whereby the anti-slipping or protective medium is free to move or shift its position around the periphery thereof." The opinion of the Circuit Court affirmed by the Circuit Court of Appeals, in discussing the prior patents which were urged in anticipation of the patent in suit, said: "What prevents these prior patents being anticipations is chiefly this, that the relation of parts which makes Parsons' novel and useful is absent."

Infringement of a Combination Claim.—The Circuit Court of Appeals for the First Circuit in recently deciding the case of Kreplik v. Couch Patents Co., says: "The infringement of a combination patent is complete when the component parts of the combination are made or sold, fitted to be put together and intended to be put together."

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12594) J. F. writes: I do not quite agree to your answer to query 12570, in which you say the day is 9 minutes longer than the night of the 21st of March. Let us take for example the 21st of March, 1911. On that day the sun's declination was 5 minutes 50.4 seconds south at mean noon at Greenwich, and was moving toward the equator at the rate of 59.25 seconds per hour; at that rate the sun's declination was 5 seconds north at 6 o'clock at sunset, at sunrise the sun's declination was 11 minutes 45 seconds south. With this data, after making correction for parallax, refraction and semi-diameter, I find the sun rose on the 21st of March at 5 o'clock and 56 minutes, and set at 6 o'clock and 4 minutes; making the day just 12 hours long. This calculation was made for the latitude of Swedesboro, 39 degrees 45 minutes north. Almanacs for everybody and everywhere are computed from a table of semi-diurnal arcs, that only give the time of sunrise and sunset for even degrees of latitude and declination, and do not make any pretense to accuracy, while they are sufficiently correct for ordinary purposes, as we do not set the grandfather clock by the sunset these days. A. We do not understand how you calculate the result that the sun rises and sets at Greenwich at 6 o'clock mean solar time on March 21st and on September 21st. We will therefore quote a paragraph from Todd's "New Astronomy," page 104, in which he discusses this point: "Almanac Sunrise and Sunset at the Equinoxes. We have seen that when the sun—that is, the sun's center—is on the equator, it rises at the same time everywhere, and that time is 6 o'clock. So, too, it sets everywhere at 6 o'clock. Why, then, do the times predicted in the almanacs differ from this? The reason is three-fold: (*a*) The times of sunrise and sunset are all corrected for refraction, which at the horizon amounts to nearly 0.6 degree, or more than the sun's whole breadth. . . . Therefore, this effect lengthens the daytime about five minutes, causing the refracted sun to rise about two and a half minutes earlier than the true sun and to set about the same amount later. (*b*) The almanac times of sunrise and sunset refer to the upper edge or limb of the sun, not the center. Here again is a cause operating in like manner as the refraction, but with an effect about half as great. (*c*) The almanac times are mean solar times of the rising and setting of the real sun. The difference between true sun and fictitious sun also displaces the time of sunrise and sunset by the amount of the equation of time; at the vernal equinox, the sun is 6 minutes slow; at the autumnal equinox, 8 minutes fast. All three effects when combined delay the sunset at the vernal equinox till long after 6, and cause the sun to rise at the autumnal equinox long before 6." This refraction gives us about 5 minutes more of daylight. Taking sunrise and sunset from the upper limb gives us about 2½ minutes, and the equation of time displaces noon by 6 minutes at the vernal equinox, so that grandfather's clock will be sorry if it is not set to take account of these things. It would not do to set it at 6 o'clock at sunset on March 21st. A commuter would lose his train in these days if it were done. The time of sunrise is computed for a zenith distance of 90 degrees 50 minutes, of which 16 minutes is the semi-diameter of the sun and 34 minutes is the horizontal refraction. After this the equation of time is applied to find the mean solar time of the appearance of the first ray of the sun, which is the moment of sunrise by the almanac. The time given differs in different almanacs, for the reason which you give, by a minute or so; but these books are not so incorrect as you seem to think they are.

(12595) F. B. A. asks: The reason ascribed for trains here being from one to two hours late continually is that the train is heavy. Would not more coal burned increase the steam power to draw the train on schedule time? A. When trains are late from being too heavy, or in very cold weather, it is because with all possible coal being burned that grates and draft would permit, there was not enough power to make the time. On the fast trains, the most powerful locomotives are fired by the most expert firemen in the effort to burn the greatest possible amount of coal and so to evaporate the greatest amount of water and obtain the maximum power. With tracks limited to 4 feet 8½-inch gage, and grates limited correspondingly, combustion has been forced to the enormous figure of 120 pounds of coal per square foot of grate per hour in the effort to make time.

(12596) A. O. K. is informed that he can have his questions about wireless telegraphy answered upon sending his address. We do not answer letters unless the name and address accompanies the letter. There can be no exception to this rule.

Canadium

A REPORT from the Nelson District of British Columbia gives news of a somewhat sensational discovery, certainly of great theoretical interest and perhaps destined to be of great practical importance. Mr. French, the metallurgist, is reported to have discovered a new noble metal, apparently entirely distinct from any of the now recognized elements and perhaps of no small commercial significance. The discovery of a new metal in anything more than infinitesimal quantities is a notable event. The following discussion of the discovery is taken from the *Engineering Record*:

"The new metal now found, called by the discoverer canadium, belongs emphatically to the group of the noble metals. It is found pure in semi-crystalline grains and in short crystalline rods and also alloyed with metals customarily found in company with platinum. It is stated that quantities up to three ounces per ton, probably from assay values, have been found in the rock, so that it at least occurs in very appreciable quantities.

"Its physical and chemical properties are interesting. It has a brilliant white luster, does not oxidize in the oxidizing flame of the blow-pipe, melts at a little lower temperature than silver and gold and is somewhat softer than platinum. From the chemical standpoint it is electro-negative to silver, is precipitated from its solution by zinc and may be separated by cupellation from lead. It is easily soluble in hydrochloric and nitric acids, is not precipitated by chlorides or iodides. It does not tarnish in damp air, sulphureted hydrogen or alkaline sulphides. This somewhat extraordinary combination of properties is one that leaves little doubt as to the genuineness of the find and raises questions of very great interest as to the character and position of the new metal. Its easy solubility separates it from the known metals which generally accompany platinum and its melting point, as stated, is at least 500 deg. Cent. below that of any of the platinum group. Sufficient data are not at hand to locate it definitely among the metals, but the possibilities are somewhat sensational."

Physicians in Germany

THE census of 1910 in Germany showed a total of 32,449 physicians in the empire. This is an increase of 480 over the preceding year, and represents one practitioner to two thousand inhabitants. The number of medical students showed a much larger increase, the numbers for 1909 and 1910 being, respectively, 9,239 and 11,125. Although in general the cities have a larger proportion of physicians than the towns, Berlin does not lead in this respect. The number of physicians per ten thousand of the population varies through a rather wide range, being as high as 22 in Wiesbaden and as low as 4 in Gelsenkirchen. Some of the more important cities have the number of physicians per ten thousand inhabitants set opposite their names below:

Berlin	12
Munich	16
Stuttgart	10
Dresden	9
Leipzig	8
Plauen	5
Chemnitz	5

The number of women who are practising medicine has been increasing rapidly. In 1908 there were only 55; in 1909 there were 69, and the number reported for 1910 is 102. Of these Berlin has the largest number, 32; and Munich, Frankfort, and Dresden report six each. The number of women studying at the medical colleges increased from 371 in 1909 to 512 in 1910.

The Current Supplement

IN the current issue, No. 1882, of the SUPPLEMENT, Dr. E. Hausmann continues his valuable article on the Properties of Selenium Cells and Their Applications. Artificial silk has been found to offer great advantages for the manufacture of incandescent gas mantles. These are brought out in an article derived from foreign sources.—A. D. Little's paper, "The Earning Power of Chemistry," is one that no educated person taking an intelligent interest in modern progress can afford to leave unread.—A splendidly illustrated article from our Paris correspondent describes the great Creusot Works, the largest iron foundry in France.—A review of the progress in the gas power engineering field in 1911 is

given by Robert H. Fernald.—The elaborate electro-pneumatic signal system of the new Pennsylvania station in New York is described and illustrated.—Those of our readers who are interested in electrical experiments will welcome an article by A. S. Dana, on The Construction of a Tesla Coil.—M. Aitken concludes his article on Automatic Telephone Exchange Systems.

The Third Award of the Scientific American Medal

(Concluded from page 90.)

late goggles have been used almost exclusively in the factories, and during this time not a single case of eye accident has occurred. The protection thus afforded is extremely effective, and offers no hindrance to the execution of the work.

The company has for a number of years been educating wheel users in the proper understanding of the attention and care necessary in the use of grinding wheels; the proper selection of the wheel for a given piece of work by means of extensive demonstration and printing information. To further this work they have distributed some 150,000 booklets on "Safety as Applied to Grinding Wheels."

Perhaps the most important of the safety devices in connection with grinding-wheel machinery is the hood inclosing the wheel, thus preventing broken pieces from doing damage to nearby objects or injuring the operator or others. This hood consists of a circular band of boiler plate somewhat wider than the wheel it covers. One of our engravings shows the position of the hood with respect to the wheel and at the same time indicating the portion of the circumference of the wheel at which the work is done. The protecting band is cut out for about one-fourth of its circumference and the two ends are joined together by means of a one-piece steel link. The type of band safety hood shown has a considerable degree of elasticity, which under actual breaking conditions permits the hood to bend out of shape, tending to straighten out the link. Repeated tests on wheels which have been speeded up to the bursting point, many times the normal working speed, have shown that the broken pieces fall harmlessly to the floor without injury to the man or machine.

Other types of hood are seen in our engravings, one of which shows the more inclosed type used on the cylindrical grinding machines. Many designs of hoods had been designed, experimented with, and tried out before these types were finally adopted. The value of these hoods may be best understood when it is said that eighteen hundred of these machines are in daily operation, and as yet not a single injury due to wheel breakage has been recorded.

Special types of protection flanges for mounting the wheels have also been designed. Practically all protection flanges embody the same fundamental principle, which is that the thickness of the wheel under the flanges should be somewhat greater than at the periphery of the latter, thus preventing that portion of the wheel so covered from being thrown out in the case of a wheel breaking.

It is, however, to be emphasized that any protection flange can be only a partial safety device, since, due to the nature of things, the flange cannot possibly hold that portion of the wheel not covered by it from being thrown off. The safety hood, when protectio. flanges are used, is not called upon to resist the force of the entire wheel, but in any event the hood must be depended upon as the real protector in case of breakage regardless of the type of flanges employed, and can never be replaced by the flange as a complete safety device. The standard type of flange is shown in our diagram, and is known as a "relieved" flange. This flange grips the wheel only along its outer edge, and by means of compressible washers permits of a uniform distribution of the pressure.

In view of the foregoing, it may be said that it is practically impossible for a serious accident to occur unless the operator is guilty of willful negligence. We may express the hope that all machinery manufacturers will speedily realize the urgent necessity of safety appliances for the welfare of the operators daily using their product, and that they will follow in the footsteps of the winner of the SCIENTIFIC AMERICAN Medal, achieving a like measure of success in the cause of humanity.

The real value of the

Cadillac

is not adequately expressed by its price

If you are familiar with motor car conditions you know that the Cadillac dealer is practically outside the zone of competition.

Almost everybody is Cadillac-convinced—almost everybody concedes its unique reputation.

But have you realized the full and splendid extent of that reputation?

It was brought home to us (for the thousandth time) in a new way, the other day, when we banteringly asked one of the most prominent dealers in the Cadillac organization:

"Don't your customers *ever* speak of other cars in comparison with the Cadillac?"

And he answered in all seriousness: "Only those of the very highest price—*and then not in disparagement of the Cadillac.*"

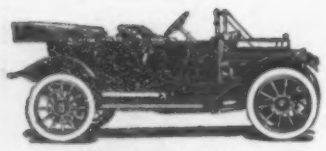
Conditions in your own locality will confirm this.

And you can probably recall several instances—as nearly everyone can—in which the ownership of much higher priced cars has been exchanged for Cadillac ownership.

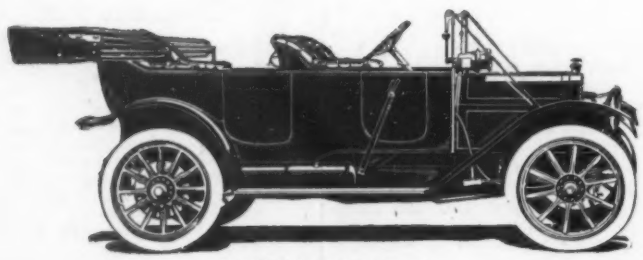
Taken together, the two sets of facts constitute a profession of confidence in the integrity of Cadillac construction which should be conclusive in establishing its value to you.

You know what a dependable car the Cadillac is. You will appreciate, therefore, how much it means when we say that there are now more than five thousand 1912 Cadillacs in the hands of more than five thousand enthusiastic users, who without exception are every day having demonstrated to them that the Delco system of automatic electric starting and electric lighting is precisely as dependable as every other feature of the Cadillac car.

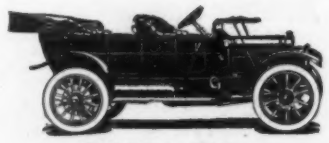
Intensified by the luxury of the system which performs the triple function of starting, lighting and igniting, the *Perfectedness* of the Cadillac has reached a point which is not adequately expressed by the money cost of the car in comparison with existing price standards.



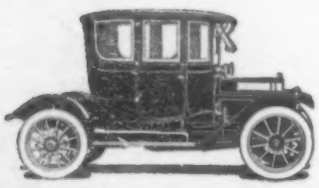
PHAETON, $1800



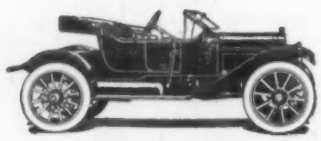
TOURING CAR, $1800



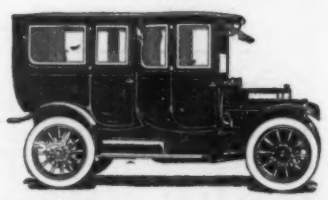
TORPEDO, $1900



COUPE, Four passenger, $2250



ROADSTER, $1800



LIMOUSINE, Seven passenger, $3250

Prices are F. O. B. Detroit and Include Standard Equipment

CADILLAC MOTOR CAR CO. - - - DETROIT, MICH.